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THE
LARYNGOSCOPE.

VOL. LX JULY, 1950. No. 7

MEDICAL EDUCATION.*
(Presidential Address.)

ROBERT C. MARTIN, M.D.,
San Francisco, Calif.

The title of this address is misleading in that I have decided to omit a formal discussion of curricula and costs. Instead, I propose to challenge the idea that "all is lost" and that a young man should not consider medicine as a career. You must continue to try to get the best type of young men and women to enter our profession and you will get them only if you abandon the defeatist attitude which so many older men now have. We want the type of man who accepts responsibility and is not interested primarily in trying for an easy life and regular hours. The latter type is literally a "dime a dozen" and will add nothing to medicine.

What follows is my personal belief and advice to the many young people, including my own son, who come to me for advice. They and their parents ask whether the shadow of forthcoming events indicates that our profession may degenerate into a conflict for political preferment in which the art of politics may supplant the art of medicine, and the science of medicine deteriorate to serve political dialectics and dogma;

*Presidential Address at the Fifty-fourth Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc., San Francisco, Calif., May 25, 1950.

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in short, whether service to the state may become the all-important thing and service to humanity and the individual purely a secondary matter.

We must not lose sight of the fact that we enjoy the highest standard of spiritual freedom, education and material living in the world. Nowhere else in the world is it so uniformly possible for everyone and anyone to get an education and rise as high as his capabilities permit. These factors are mentioned to show that it must be difficult to persuade people enjoying these privileges to substitute something as a system which promises far more but delivers little. It would be trite at this point to cite certain well known schemes in other countries, which seem very definitely to be found wanting.

You may ask, "But what of the growing spirit of radicalism in our schools? Does it not indicate a desire for social reform?" May I answer that I do not like that word *reform*. As I understand *reform*, it means a change of conditions for the better and not retrogression. I insist that to go back to stateism is regression — not progress; and reform is not the word. "Social change," if you wish, but not reform. It reminds me of the furious appellations of "reactionary" that issued from the empty brains and open mouths of so many do-gooders in late years. In reality those of us who are so tarred and feathered are the progressives and our critics who advocate regression to an all-powerful state are the reactionaries.

The spirit of radicalism is a desire for change rampant in all normal youth; but this younger group is a minority, vociferous out of all proportion to its size. It will soon become mature and disillusioned as to the value of stateism and the political machine of perpetual motion where no energy is introduced, but from which much issues. They will soon learn that the philosophy of "something for nothing" in any society is no more possible than is perpetual motion in the field of physics. This desire for social change is a normal condition in youth and does not indicate that we are headed for the rocks. I believe it was Voltaire who said, "Show me

a man of 25 who is not socially conscious, and I will show you one who is lacking in human sympathy; but show me a man at 45 who is still markedly so, and I will show you one utterly lacking in intelligence." This perhaps is an overstatement, as most of us who are 45 or over are socially conscious; but we hope this consciousness is leavened with experience and understanding. One cannot literally bump one's head against special privileges, be the special privilege that of a rugged individualist, bureaucrat or professional loafer, without tempering his desire for the milk of human kindness with the element of human justice; but until one has had those bumps, he has no yardstick by which to measure the materialism of the average human, as manifested unfortunately in our everyday life and to which all of us are in a measure a part. Is the spirit of youthful radicalism and advocacy of social change to be decried? No! Without it there would be little progress and it is most necessary to stir up things with thought even though one does not agree with that thinking. I believe that the counterbalance of maturity and experience is sufficient to direct and modify this energy and unrest so that the fusion of both attitudes may become a workable entity to the advantage of all of us. This progress will not be an even line but will be irregular and characterized by excesses of zealots on either side, but I believe wholeheartedly that the graph will show a gradual evolution of a system of medicine better for society and for the presently essential but politically forgotten man, The Doctor.

Most of you studied medicine because you enjoyed the relationship with humans as individuals and with an idea of helping them through pain, sickness and personal problems. With most of you it was necessary that you be self-supporting in order to do these things, and you hoped to be given the privilege of providing for your old age. I further believe that you studied medicine because you enjoy the individualistic type of life you are allowed to lead, even with its attendant responsibilities and being continually tied to the telephone. The type of medicine you entered, whether it took the form of surgery or medicine, depended upon your bent. A minority blessed

with an investigative turn of mind did research; again with the idea of helping the human individual. Certainly monetary gain never led anyone into the field of research. I challenge the statement that any of you studied medicine entirely for pecuniary reasons, for if you did you showed a low order of financial intelligence. There are far greater gains in dollars and cents made in other fields without the surrender of the personal freedom that a successful medical career entails.

I do not believe that a bureaucratic system with the Utopia of financial security and regular hours for the doctor appeals to the prospective student. The former is a figment of the imagination and the latter, theoretically desirable though it may be, robs medicine of its greatest burden and its charm which is individual responsibility. For one, I do not want the next "shift" to take over a patient about whom I am worried! That is my responsibility.

My son says, "Dad, I would like to study medicine." My answer is, "Fine, if you are sure that is what you want. The pendulum may swing to lower standards and loss of individuality, but people cannot be fooled all of the time and some day it will swing back and I hope settle to a midpoint of common sense. It may be after your time before another Magna Charta can be forced from the hands of reluctant privilege holding politicians. As surely as I know human nature after years of practice, you will find that both donor of service, the doctor, and recipient of service, the patient, will eventually fight to retain or regain their individuality and self-respect.

"So go ahead, if you are certain you really want to study medicine. It is a good, though rugged way of life. You will miss taking my grandchildren to football games and to the theatre many times because of some imaginary ailment of one of your patients; but the real emergency which is often there when you arrive will give you compensation for the false alarms, and the missed good time.

"Stand for what you believe is right and don't go along with the crowd just to be popular, and you will be glad that you

have studied medicine; and I think you will have a good life even though changes come, changes to which your father and older men will have difficulty adapting themselves. You will not have that difficulty. You cannot find a more satisfying way of life nor one where you can help people more. We older folk have tried to do a good job. You will doubtless do better."

MEMORIES OF POST GRADUATE TEACHING.*

HARRIS P. MOSHER, M.D.,
Marblehead, Mass.

First I thank Dr. Martin for the high honor of choosing me as the Guest of Honor of this meeting of the Society under his chairmanship. It is deeply appreciated. It brings back very pleasant memories of when he was with me as a student in the rather distant past. He was outstanding then, and, as you know, has continued that characteristic.

On looking at the members of the Association before me, it is easy to see three or four faces whose looks speak louder than words, and say, "Will he never quit and give us a chance?" The October issue of the *Saturday Evening Post* of last year carried the sentence, "The late Dr. Harris P. Mosher." This should give these men hope; but I find it a queer sensation to be both dead and alive.

The psychiatrists say that confessions are the catharsis of the soul, so I have a few to make. My first is that I shun the word "old." To speak it brings crashing down upon me the heavy weight of the accumulated years, and I find that I am becoming as sensitive about telling my age as a woman over twenty.

Second, you can date me by the following incident. At a neighboring hospital where I recently had a check-up, the nurse who prepared me for a chest X-ray and a day or two in the hospital was heard to say, "Think of it, I have just found a man who still wears garters."

Third, show me the photographs of your children once but, please, not every time we meet. Be merciful, as I have no

*Read at the dinner given by the local and Western members to the visiting members of the American Otological Society, American Laryngological Association, the American Laryngological, Rhinological and Otological, and the American Bronchological Societies, May 27, 1950, at Fairmont Hotel, Nob Hill, San Francisco, Calif.

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children. Remember that I, too, was a beautiful golden-haired baby; at least my mother had to say so, in order to keep up with all the other mothers.

Fourth, my bluff, staccato manner is deliberately put on. When I was in flower, so to speak, people came to me because they wanted something, and this manner brought them at once to the point. I found it very useful, and survived in spite of it. From the first I have been conscious that neither Chesterfield nor his successor, Emily Post, nor Dale Carnegie, would recommend it.

So much by way of introduction. My topic tonight is "Teaching." All that I have to say is reminiscent of my post graduate courses. All that I know about teaching I learned in them. Half or more of what I have to say is in a light vein; the rest, at least to me, is serious.

My courses featured applied anatomy. I held that it was only if you knew your anatomy were you ready for surgery. The parts of my post graduate course which I hoped to be of the most lasting value were: First, a comprehensive series of drawings of picked anatomical and surgical specimens. A drawing was always started in the tracing box, and then finished according to the student's native skill in drawing, and with what help I could give him as he went along. Second: A series of casts to supplement the drawings was made from master casts or from the cadaver. The casts, unlike the drawings, were in three dimensions and constituted an anatomical and surgical library which ranked next to the cadaver for study, and was always available.

I have always liked to work with my hands. To measure a significant anatomical or surgical specimen, to draw it, or to reproduce it in permanent form was an inborn and always an increasing and lasting pleasure.

The universal remark made by the students at the beginning of a course—and it rings plainly and plaintively in my ears, even yet, was: "I cannot draw." My answer to this always was: "Trace,—use the tracing box. An accurate tracing is worth more than a pretty, inaccurate drawing. Meas-

ure everything, and record the measurements on the drawing." I have long had the feeling that repeated measurements leave a record in the cerebellum, and when a motion becomes automatic the cerebellum outranks the cerebrum in bringing this about. This is the reason why I have the students measure everything. It is the job of the cerebellum to regulate and coordinate movement. Regulating is but another word for measuring.

My post graduate courses began in 1898 and ended in 1939, roughly some forty years. They were interrupted only by the first World War.

I had the good fortune to have mature men,—no G. I.'s. I found the ideal class to be ten,—with two or three incoming house officers as strikers. For a short time I had twenty men which practically made the course pay the medical school's share of my salary. I always felt that the administration considered this the most important thing about the course. In the beginning I paid for my own school equipment.

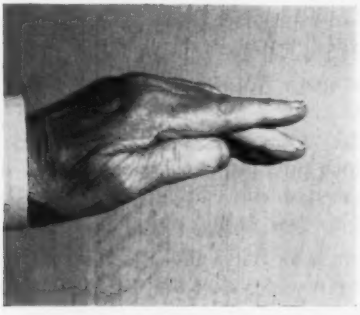
I soon found that I could not give a course without stopping private practice. Frankly, I did not have to give up much. For seven weeks I lived at the medical school. I was there every day until five o'clock, but I admit that I sometimes watched the clock. Often, I made a surprise evening visit. We all dined together at noon in Vanderbilt Hall, the medical school dormitory. At the end of each course there was a party for the men and their wives. The instructors who helped me came, too; the chief ones were Dr. Berry, Dr. Schall, Dr. Knowlton, Dr. Kazanjian and Dr. Mueller. They have been thanked before, but I take this, and probably my last, opportunity, to thank them again for their faithfulness to me, and the cause of teaching.

The course always began on a Monday night at my house at the unfashionable and rather shoddy end of Beacon Street. This was our "coming out party," and a chance to get together a bit socially. It proved very useful because I could begin to size up the men and they could do the same with me. There was generally a blizzard on this night. I told the men what I expected of them, especially their working hours, which

were from nine in the morning to ten at night, Sundays and holidays. These may seem pretty long hours, but because of them I soon stumbled upon a bit of useful psychology. This was that the men when they got home bragged about their slave life with me, and I capitalized on this and never shortened their hours.

At the coming out party I announced that the wives the men brought with them were to consider themselves actual widows for the coming seven weeks. Often some of the men had already been accepted as house officers at the infirmary and were used in the course as helpers. Naturally, their wives, if they brought any, stayed on. Most of these took jobs to help out with the pathetically simple homes they were able to establish. I am writing these few lines to express my admiration for these plucky souls, even if one of them, in order to make sure of her man, married him almost on the way to the railroad station.

Each week ended with a quiz. I soon found that in order to make this worthwhile and not simply a parrot-like exercise, I had to arrange it carefully. On one of the quizzes after the men had finished their work on the ethmoidal labyrinth, I gave to each man or, rather, tossed to him, baseball fashion, a ball of clay. This purposely was made large. I gave my thumb and forefinger measurement as a rough guide and asked them to make a model of the ethmoidal labyrinth with eyes shut. This measurement on my hand is two inches and is the dead-line measurement in the nose.



On my hand, from the tip of the thumb to the tip of the forefinger, is two inches.

Half of the models which were turned in were passable, but three or four would have done for a cow or an elephant. After the exercise the class were an humble lot, and this rather pleased me.

I was proud of the student lectures. Each man was assigned one and worked over it as though his life was at stake. To illustrate their lectures they almost depleted the medical school museum. The poor devils had the habit of rehearsing in the nearby washroom, and often found relief in all its facilities.

To turn from my course for a moment to the teaching of the third year class of the medical school, — I still hold, although lectures are now somewhat in disrepute, that a limited number of lectures are worthwhile and necessary, to correlate the specialty with general medicine and surgery. If a lecturer cannot, from his experience, give a perspective of his specialty not to be found in the textbooks, he is not worth his salt as a teacher. To give this correlation to third year students should be his first and chief job.

The following are some of the little happenings at the courses:

Young Lynch, now not so young, saw snow for the first time when he came to the infirmary as house officer. He and his wife lived on the northern slope of Beacon Hill, which then, as now, was the Latin Quarter of Boston. When the first snow storm came along, he rushed out of the house to feel of it, and to play in it like a child.

Bacher, of San Francisco, saw his first snow in the courtyard of the medical school, and he began at once to eat it.

At a get-together party, I noticed that one of the men wore a large diamond ring. I never had a diamond ring and never expect to. So, I could not help saying that the dissecting room was no place for diamonds. I turned my head, and when I looked back the man had slipped the ring off his finger into his pocket, and I never saw it again.

Every three or four years the weather was mild enough for the men and their wives to come to Marblehead. On one of

these occasions, we all had lunch together in neighboring Salem at the Hawthorne Hotel. Mrs. Mosher sat at one end of the table and I, correctly, sat opposite her at the other end. After the party was well underway, I looked up and could not see her. When she was fished out from under the table, it was found that the legs of her chair had collapsed. Examination showed that four or five other chairs were in condition to do the same. These were replaced, and the luncheon continued normally to the end.

There were two Belgians, each in a different year. One was asked to give his description of the course and said, "Mud, plaster and glue." The other when at Marblehead, was standing with Mrs. Mosher in the garden, looking out over the harbor, and broke the silence with the remark, "You have a fine belly view." He was right.

Another year again there was a man from overseas. It turned out that he never had had a hammer in his hand, so never had driven a nail, and knew a rake only by name. Our lawn had just been fertilized. Mrs. Mosher, out of pure deviltry, gave him a rake and asked him to help her clean up, and he was gallant enough to do it. He probably was something of an aristocrat at home; but I could not help thinking that he had missed most of a boy's real joys, that is, working with his hands. In England and on the Continent, home life ceases when, around twelve to thirteen, boys are sent to boarding school, and from then on become young gentlemen. If this is what had happened to him, I suppose he signed checks at fifteen, complained of his allowance, and at his university had a mistress.

Marblehead has some very crooked streets,—London none more so. It was my custom to bring my car full of "Course" men by what I announced to be the straightest road in Marblehead, but really was the most crooked. Usually the men were duly astonished, but once one of the men remarked that he preferred the straight roads of the west where the intersections were always at right angles, and you could go 500 miles without reaching your next-door neighbor. Naturally I had no *further use* for him.

At another time, there was a man who had never seen the sea. Just beyond our house there is a straight and clear shot for three thousand miles across the Atlantic to the Bay of Biscay. When the tide is high, the water of Marblehead Bay reaches within ten feet of the retaining wall of our garden. As soon as this man reached our house, he rushed down to the water's edge and dished up a handful of water to find out if it was really salt. It was very evident that he did not swallow it, and that one mouthful was enough.

Kennon and his running mate, both from the upper South, each had a keen dry wit which he used constantly, and kept the members of the course in a chuckle. Both had a tinge of the soft Southern voice which many of us here in the North envy. Kennon was tall and his mate short, so that they soon became known as Mutt and Jeff.

At the party on the first night of their course, one of them—I think, Jeff—produced a bottle of White Mule, and gallantly offered it first to Mrs. Mosher. It smelt and tasted like hair oil or worse, and she could not get it down. None of the rest of us could either, so the two of them quickly emptied the bottle, alternating drinks so that each got his full half.

A short time before Kennon's death about two years ago, he said in a letter, "I am hungry to see you again." I never had comradeship expressed more delicately, or deeply.

The party at the end of the course was an open season on me. I was fair game, and the men made the most of it. The instructors and the various members of the class also came in for gibes. One year just before party time, one of the men had a birthday. At the party, he was presented with a plaster of Paris birthday cake. As it was being handed to him, it was purposely dropped—it fell with a deadly, uncake-like thud, and broke to pieces. When the applause and laughter died down, Mrs. Mosher presented him with a fine, proper cake. The afternoon party over, we usually went for dinner to the Wayside Inn of Longfellow fame. At the dinner there often was a presentation. Over the years, I received an assortment

of gifts varying from goldfish to a gold watch. Bacon, one of the wisest heads the English world has ever known, says in his essay on Fortune,—"And certainly there be not two more fortunate properties than to have a little of the fool, and not too much of the honest." These parties were silly, foolish affairs, but they ended the tension of the previous weeks. For those who raise their eyebrows at them, I have this to say: "I pity their wives for the empty lives they have to live with them."

Now, a word more about teaching.—It is becoming increasingly hard to get young men in our locality to give up time from their practice for teaching. All teaching should be paid for. The amount depends upon the budget of the department. In my beginning days, we were supposed to do anything we were capable of doing for the older men, for nothing. Happily, those days are over. Getting a practice is harder than it used to be, especially in a large city, and raising a family today is more costly. I feel that I have led a sheltered medical life because, thanks to my father, and later to Mrs. Mosher, I had a small private income from the start.

Speaking generally, when you try for a reason why a man should take up teaching, the first one which comes to mind is that he does it to make a living, and does it in spite of the fact that the living proves to be a modest, if not a meager one. The crudest explanation of all, one which is only a poor wise crack, is that, if married, he cannot be boss at home, but hopes he can in the school room.

When you are honest with yourself, you realize that one of your most constant dreams is to leave something behind to be remembered by, and you hope that something in your teaching may do this. One remark of mine, perhaps, may do this for me, namely: "Respect the virginity of the nasofrontal duct, or take the consequences."

I cannot help feeling that in teaching there is an inborn element of the urge to lead and direct, as in the leader of the herd or the mob; but it is hard to believe that those teachers

who live in ivory towers, sung, warm and protected, like a human caterpillar in a cocoon, have this feeling for leadership.

In closing, allow me a general remark or two about teaching. In speaking, a teacher should radiate enough strength to command attention, and, if possible, respect. A weak voice and manner have no place in a class room at any grade. More than once I have said to my students that they should feel that what they were saying in their assigned talks was the most important thing being said in the world at that moment. Without being brazen, they were to put some strength into their voice and manner.

A few teachers help to make their points as much by their mannerisms as by what they say. I am not advocating clowning, but action is life and life is contagious.

As I see it, the fundamental fact about teaching is that the teacher's personality is what makes him successful or a failure. To attempt to define personality would soon put me over my head in metaphysics, and at once put you listeners to sleep. One set of thinkers hold that God has no personality; fortunately, we as humans have. Philosphers often rank personality as the basic, divine spark in a human being. There is truth in this, even if it does sound like tall talk.

One thing about teaching seems clear, at least to me, and this is that every teacher, consciously or unconsciously, has the instinct of a showman and, at his best, is a showman. I refrain from naming present-day examples.

127 Front Street.

POLIOMYELITIS-TONSILLECTOMY SURVEY — YEAR 1949.*†

DANIEL S. CUNNING, M.D.,
New York, N. Y.

The statistical report which I am about to present completes a four-year nationwide survey conducted by this Society in an effort to determine whether or not there is any relationship existing between poliomyelitis and tonsillectomy and, if so, whether it be causal or coincidental.

Ever since the greatly publicized family of five children in Akron, Ohio, developed bulbar poliomyelitis following tonsillectomy some years ago, epidemiologists, The National Foundation and State Boards of Health throughout the country have strongly advised parents to forego their children's tonsillectomies during the Summer months.

As tonsillectomy was offered as one of the chief causes of this dread disease, and being physicians endeavoring to save human life rather than destroy or jeopardize it, we meekly accepted this theory and discontinued tonsillectomies during the Summer months. Many of us frankly doubted the validity of this conclusion as experience with thousands of tonsillectomized patients had not yielded any evidence to substantiate the theorizing of our associates.

Being a representative group of organized medicine and vitally interested in the settling of this controversial question, our present committee on the study of the poliomyelitis-tonsillectomy question was formed. Most of the members of our committee have worked tirelessly and their gratifying interest and cooperation is above reproach. To these state chairmen

*Read at the Fifty-fourth Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc., San Francisco, Calif., May 25, 1950.

†From the Manhattan Eye, Ear and Throat Hospital, New York, N. Y.

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Cases of Poliomyelitis - By Age - Type of Disease - Operative Procedures---------Table I.

Age	Bulbar			Spinal			Mild		
	Total Cases	Operations T&A	Others	Total Cases	Operations T&A	Others	Total Cases	Following T&A	Others
0 - 5	6575	29	36	656	7	7	4261	16	25	1658	6	4
6 - 10	4897	28	43	919	13	12	2434	12	21	1544	3	10
11 - 15	2911	5	23	570	1	10	1424	2	11	907	2	2
16 & over	4864	0	60	1007	0	15	2515	0	31	1352	0	14
Total	19247	62	162	3152	21	44	10634	30	88	5461	11	30

and all the ear, nose and throat physicians who have aided, I take this opportunity to say thank you, most sincerely, for your contribution in our Society's endeavor; however, this survey has assumed gigantic proportions, and we feel it an imposition to further tax our members, who, with their heavy

Type of Disease - Operative Procedure and Poliomyelitis By State - Year 1949.

State	Total Cases		Bulbar		Spinal		Mild	
	Total	Operations TAA Others	Total	Operations TAA Others	Total	Operations TAA Others	Total	Operations TAA Others
New Jersey	1086	3	190	1	588	1 0	308	1 0
North Carolina	184	3	19	0 0	131	2 0	34	0 0
Texas	1833	0 0 0	246	0 0 0	1131	2 0 0	454	0 0 0
New Mexico	207	2 0 4	55	0 0 2	65	0 0 0	87	0 0 0
Georgia	182	0 4 0	40	0 0 2	78	0 0 0	64	0 0 0
Oklahoma	778	3 0 0	165	0 0 2	540	0 0 0	73	0 0 0
Delaware	147	0 0 0	37	0 0 0	85	0 0 0	25	0 0 0
Arkansas	505	3 0 0	46	1 0 0	451	3 0 0	20	0 0 0
Wisconsin	752	3 3 3	100	2 0 0	412	1 4 0	240	0 0 0
Missouri	59	2 4 0	70	1 0 0	220	4 3 0	33	0 0 0
Connecticut	645	0 0 0	70	0 0 0	556	3 0 0	19	0 0 0
Rhode Island	103	0 0 0	25	0 0 0	67	0 0 0	59	0 0 0
Arizona	153	1 1 2	27	0 0 0	84	0 0 0	52	0 0 0
District - Columbia	103	0 0 0	25	0 0 0	46	0 0 0	50	0 0 0
South Carolina	87	0 0 0	16	0 0 0	59	0 0 0	66	0 0 0
Virginia	163	1 2 2	18	0 0 0	79	0 0 0	38	0 0 0
Louisiana	525	3 4 0	35	0 0 0	385	0 0 0	145	0 0 0
Alabama	369	0 0 0	19	0 0 0	197	0 0 0	102	0 0 0
Mississippi	311	0 3 4	58	0 0 0	191	0 0 0	29	0 0 0
Oregon	225	0 0 2	102	0 0 0	108	0 0 0	199	0 0 0
Kansas	510	3 4 2	18	0 0 0	209	0 0 0	99	0 0 0
North Dakota	180	0 2 0	16	0 0 0	63	0 0 0	37	0 0 0
New Hampshire	107	0 2 1	27	0 0 0	67	0 0 0	30	0 0 0
Massachusetts	1467	2 6 6	270	1 5 6	671	1 5 0	537	2 6 0
Michigan	166	4 0 4	45	0 0 0	76	0 0 0	69	0 0 0
Washington	392	2 0 4	80	0 0 2	220	0 0 5	92	0 0 3
Idaho	358	0 4 0	125	0 2 3	176	0 5 4	57	0 0 3
New York State	2295	12 22	363	4 5 6	1310	2 9 6	622	1 0 4
New York City	2456	17 15	392	4 5 6	1709	6 6 6	445	4 0 0
Ohio	1191	4 1 2	219	2 0 0	740	1 0 3	230	0 0 0
Tennessee	199	2 3 4	39	0 0 4	116	0 3 0	16	0 0 0
Maryland	171	2 0 3	60	2 0 2	84	0 0 0	95	0 0 0
South Dakota	339	3 4 3	101	0 0 0	150	0 0 0	69	0 0 0
Florida	129	2 0 2	37	0 0 0	109	0 0 0	30	0 0 0
Nebraska	126	1 0 0	37	0 0 0	55	0 0 0	27	0 0 0
Colorado	216	0 0 -	55	0 0 0	156	0 0 -	25	0 0 0
Utah	113	0 0 -	26	0 0 0	58	0 0 -	29	0 0 0
Wyoming								
	19247	82 162	3152	21 44	10634	30 88	5461	11 30

office and operating schedules, cannot very much longer stand this additional burden. Were we financially able to alleviate this condition, we would willingly do so, but all of our attempts to obtain financial aid were met with disapproval and rejection.

Needless to say, we have not been completely satisfied with the results of our surveys, as it is easy to see that a study nationwide in its scope has its drawbacks and does not allow for detailed and adequate research. Being cognizant of this fact, the writer, in 1947, proposed a new approach to the

Table III

Distribution by Types of Involvement-Number and Percent

Year 1949.

	Total Cases	Cases Preceded By T&A		Cases Preceded By Other Operations	
		Number	Percent	Number	Percent
Bulbar	3152	21	0.7	44	1.4
Spinal	10634	30	0.3	88	0.8
Mild	5461	11	0.2	30	0.6
Total	19247	62	0.3	162	0.8

problem and one that might well provide a conclusive answer. Instead of obtaining through state health departments and private physicians and surgeons the records of poliomyelitis cases which had already occurred and then searching their

histories for evidence of previous recent tonsillectomies, it was proposed to set up a study which would answer directly the pertinent question — "Are children who have been tonsillectomized during the Summer months more likely to contract poliomyelitis than nontonsillectomized children of the general child population?"

Table IV

Distribution by Age-Number and Percent-Preceded by T&A's and Other Operations

Year 1949.

	Total Cases	Cases Preceded By T&A		Cases Preceded By Other Operations	
		Number	Percent	Number	Percent
0-5	6575	29	0.4	36	0.5
6-10	4897	28	0.6	43	0.9
11-15	2911	5	0.17	23	0.8
16&over	4864	0	0.0	60	1.2
Total	19247	62	0.3	162	0.8

As outlined, the study would follow several thousand children who would ordinarily be tonsillectomized during the months of June, July, August and September. So that varying

epidemic characteristics of the disease would be properly balanced, it was planned to select approximately 20 hospitals throughout the United States to cooperate in the study. At the time of admission to the hospital, there would be attached to the regular chart a special card listing pertinent information regarding age, sex, color, date of tonsillectomy and space

Table V
Bulbar Cases Following Tonsillectomy

Locality	Age	Number of Days Following T&A
New Jersey	6	Day of onset
Texas	2	6 days
Oklahoma	5	14 days
Oklahoma	5	13 days
Arkansas	3	Day of onset
Arkansas	9	14 days
Wisconsin	10	15 days
Massachusetts	12	14 days
Ohio	3	8 days
South Dakota	6	22 days
South Dakota	7	14 days
Nebraska	6	21 days
Nebraska	8	9 days
Maryland	6	14 days
New York State	7	10 days
"	6	7 days
"	6	12 days
"	9	6 days
New York City	5	6 days
"	5	9 days
Ohio	8	14 days

for comments for a weekly one-month follow-up study. Following tonsillectomy and the patient's discharge from the hospital, the card would be turned over to special social service workers for follow-up at weekly intervals to determine whether or not poliomyelitis ensued. Such a study, properly supervised and tabulated, would give conclusive evidence

whether the incidence of poliomyelitis in recently tonsillectomized children was significantly greater than the normal incidence of the disease in the general child population.

Table VI

Deaths from Poliomyelitis

Age Group	Cases of Poliomyelitis	Number in which Death Resulted	Case Fatality Rate
0-5	6575	195	2.9
6-10	4897	228	4.6
11-15	2911	152	5.2
16&over	4864	474	10.0
Total	19247	1049	5.4

Having taken all aspects of this problem into consideration, we have decided that we already have at hand enough material from our surveys to formulate an opinion and that

the continuance of this survey would only be superfluous data. Narrowing our fields somewhat, we feel that were we to investigate the cases in the City of New York, *i.e.*, comparing the tonsillectomized and nontonsillectomized child population, more concise data could be obtained and follow-up more de-

Table VII

Bulbar Type of Poliomyelitis

Year 1949.	
Total Number Cases Poliomyelitis	19247
Total Number Cases-Bulbar Type	3152 or 16%
Bulbar Cases Following T&A	21 or 0.7%
Bulbar Cases Following Other Operations	44 or 1.4%
Bulbar Cases Following No Operations	3087 or 97.9%

tailed and advantageous. This I plan to do and if anyone from the larger centers would care to volunteer his services and follow my proposed procedure, I would be delighted to discuss the matter with him at further length.

Several of our state chairmen's reports, unfortunately, could not be incorporated in our standard charts as they, the chairmen, found it impossible to obtain the necessary data that would conform to our pattern of tabulation. This was due to

Diseases and Accidents Preceding Onset of Polio

Table VIII

Year 1949.

Tooth extraction	removal-ingrown toenail
pregnancy	herniorraphy
appendectomy	recession
delivery	gum boil
episiotomy	vaccination
myringotomy	nail in foot-tetanus shot
chicken pox	shot in finger-tetanus"
cut foot	incomplete abortion
whooping cough	pneumonia
incision-axillary abscess	circumcision
head injury	auto accidents
perineal abscess repair	ear and sinus infection
miscarriage	teeth filled
herniotomy	lacerations
cellulitis	tracheotomy for croup
kidney stone-removed	mangled hand-repair
lacerations of hip-sutured	falls
epistaxis-cauterization	cholecystectomy
fractured bones	dilitation and curettage
incised boil-buttocks	

either the lack of cooperation on the part of the state departments of health or to the respective states' high rate of incidence of poliomyelitis which in these few states was so unusu-

ally high that it would have necessitated additional secretarial workers. Due to circumstances beyond our control, this situation could not be avoided.

Table IX

BULBAR CASES FOLLOWING TONSILLECTOMY

STATE	TOTAL CASES	BULBAR	STATE	TOTAL CASES	BULBAR
ARIZONA	422	0	NEBRASKA	404	0
ARKANSAS	232	0	NEW JERSEY	1148	0
CALIFORNIA	9177	0	NEW MEXICO	100	0
COLORADO	316	0	NO. CAROLINA	1943	0
CONNECTICUT	1081	0	NO. DAKOTA	67	0
DELAWARE	2936	0	OHIO	2545	0
D OF C	260	0	OKLAHOMA	273	0
FLORIDA	698	0	OREGON	484	0
GEORGIA	599	0	PENNSYLVANIA	7530	0
ILLINOIS	2671	0	RHODE ISLAND	964	0
INDIANA	1568	0	SO. CAROLINA	598	0
IOWA	975	0	TENNESSEE	946	0
KANSAS	140	0	TEXAS	1434	0
LOUISIANA	837	0	VIRGINIA	1537	0
MASSACHUSETTS	4154	1	WASHINGTON	115	0
MICHIGAN	2087	0	WISCONSIN	354	0
MINNESOTA	313	0	N.Y. STATE	10643	1
MISSISSIPPI	300	0	CANADA	211	0
MISSOURI	806	0	HAWAII	72	0

TOTAL(1949).....61340.....2

Previously Reported(1948).....35039

Totals 1946-1947-1948-1949.....96379

Total number cases following tonsillectomy.....7 or .0000735

CONCLUSIONS.

Having completed this four-year study of 36,678 cases of poliomyelitis as well as 96,379 cases of tonsillectomies, we fail to see any causal relationship existing between poliomyelitis and tonsillectomy nor, up to and including the present time, have we read any published reports from other sources that offered any conclusive proof that tonsillectomy does predispose to bulbar poliomyelitis.

As we have said in previous years, we see no reason why tonsillectomy should be indefinitely postponed simply because the summer months are the months wherein poliomyelitis is prevalent; however, we do not advise any elective surgery being done during any epidemic, regardless of its nature.

STATE CHAIRMEN
POLIOMYELITIS SURVEY
YEAR 1949

Alabama	Gilbert E. Fisher
Arkansas	Paul L. Mahoney
Arizona	Joseph M. Kinkade
California	Howard P. House
Colorado	James P. Rigg
Connecticut	Edward R. Roberts
Delaware	William M. Pierson
Washington, D. C.	Samuel L. Fox
Florida	Charles C. Grace
Georgia	Russell B. Burke
Idaho	Roy La Vern Peterson
Illinois	Oliver E. Van Alyea
Indiana	Carl H. McCaskey
Iowa	Clair M. Kos
Kansas	William P. McKnight
Kentucky	William C. Wolfe
Louisiana	James W. McLaurin
Maine	Fred T. Hill
Maryland	Samuel L. Fox
Massachusetts	Robert L. Goodale
Michigan	J. Louis Dill
Minnesota	Lawrence Boies
Missouri	John C. Howard
Mississippi	Edley H. Jones
Montana	Voss Harrell
Nebraska	Lyman H. Heine
Nevada	Voss Harrell
New Hampshire	John A. Murtagh
New Jersey	Edgar P. Cardwell
New Mexico	Franklin P. Schuster

New York City	W. Wallace Morrison
New York State	Benjamin M. Volk
North Carolina	Watt W. Eagle
North Dakota	Nelson A. Youngs
Ohio	Harry C. Rosenberger
Oklahoma	William L. Bonham
Oregon	Lewis W. Jordan
Pennsylvania	Harry P. Schenck
Rhode Island	Nathan Bolotow
South Carolina	Richard W. Hanckel
South Dakota	Paul G. Bunker
Tennessee	Guy M. Maness
Texas	Franklin P. Schuster
Utah	James P. Rigg
Vermont	De Forest C. Jarvis
Virginia	Elbyrne G. Gill
Washington	Raymond A. Lower
West Virginia	Unable to obtain chairman
Wisconsin	Thomas L. Tolan
Wyoming	James P. Rigg

FURTHER OBSERVATIONS OF THE EFFECTS OF THYROID INSUFFICIENCY ON THE NASAL MUCOSA.*

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St. Louis, Mo.

Occasional reference has been made in the literature to the effect of thyroid activity, and more particularly thyroid deficiency upon the nose. The appearance of the mucosa under this condition has been variously described as wet, dry, red, pale and white. McLaurin[9] mentions "the negative and unimpressive character of most of the signs"; Morrison[11] refers to "a pretty normal nose, except that it does not function properly."

Impressed by the frequency with which hypothyroidism once recognized, suggested itself as a causative factor in nasal disease and headache, the present author collected some 80 cases for review. A brief report was read before the American Laryngological Association (1948).

Fifty more cases have now been added and incorporated in the study. The series is still too small to permit any but the most casual statistical deductions, so that present findings are based upon a careful study of cases selected because the diagnosis was reasonably certain, confusing complications did not exist and response to thyroid extract was demonstrable.

In the preliminary report[12] were listed the following tentative observations:

1. That deficiency of the thyroid hormone may result in changes in the nasal mucosa which can be recognized as such,

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2. That these changes may be either of two types: *a.* red, dry, irritated and desquamative or "chapped"; *b.* pale, wet and boggy,

3. That patients deficient in thyroid hormone may have an increased tendency to nasal infection and nasal allergy which can be corrected (or at least influenced) by the administration of thyroid extract alone,

4. That headache and nasal obstruction are prominent symptoms,

5. That the basal metabolic rate is helpful but not infallible in distinguishing cases suitable for treatment with thyroid extract, and

6. That the basal metabolic rate is not a reliable prognostic index but that in all cases the response of the patient is more useful, and determines the optimum dosage as well.

Some of the cases here under discussion belong in the group of extreme deficiencies, but on the whole they are found in individuals who would receive little or no thyroid treatment from the physician on the grounds of findings outside the nose.

Briefly stated the present findings are as follows:

Total cases	130
First suspected of hypothyroidism on basis of nasal appearance alone	66
Previously diagnosed	52
Incomplete	4
Suspected of hypothyroidism but reported plus B. M. R. (Seven of these were males)	8

AGE.

	Females	Males
1-10 years	1	0
11-20 years	4	3
21-30 years	21	5
31-40 years	29	11
41-50 years	27	7
51-60 years	7	2
61-70 years	4	1
	93	29

COURSE.

	No.	%
Improved	56	45.9
Not improved	21	17.3
Doubtful or incomplete	45	36.8

MUCOSA.

	No.	%
Red	48	39.3
Pale	18	14.7
Mottled or nondescript	56	46
(Of the 18 pale membranes only six, or one-third, were in subjects known to be allergic.)		

SYMPTOMS.

	No.	%
Rhinitis	130	100
Dry nose	34	26
Asthenia	21	17.3
Headache	60	50
Chilliness	7	5.7

On the basis of the foregoing the typical case is difficult of description. The patient, if a woman, may be of any age; if a man, he is likely to be in his middle thirties. Examination of the nose is not pathognomonic. While the "dry, chapped" type and the "white, pulpy" type preponderate, these are found in other conditions as well. Asthenia, chilliness and myxedema are infrequent, probably because most of these cases are not so seriously deficient. Headache was present and of sufficient severity to be complained of, without prompting, in half the cases.

Probably most characteristic is the utter failure of both nose and patient to respond to the usual measures. Colds are not severe but interminable. Low grade vasomotor reactions follow the slightest and most varied stimuli. The turbinal bodies look as though they had been made of poor materials.

From what is known of the effects of thyroid deficiency on other tissues, such nasal symptoms might be expected.

Means[10] devotes a chapter to "Thyroid Administration in Diseases of Other Than Thyroid Origin — which is to say the use of the thyroid hormone for its nonspecific drug action" in which he cites references to changes in the adrenals, the kidneys, the blood, the stomach, the nerves, the intestines, the genital organs, the skin, the heart, the ear and the eye! This alone might be regarded as presumptive evidence of changes in the nose, an organ characterized by the most sensitive of neurovascular, glandular and epithelial tissues.

"Broadly speaking," writes Means, "the thyroid hormone has to do with the rate of growth and differentiation of tissues, with the rate of energy exchange, with the metabolism of proteins, carbohydrates, fats and lipoids, salts and water, with the irritability of various tissues and with the activity of other endocrines." Is it conceivable that the nose could escape all this?

Byrom[1] hypothesizes a laxity in the intercellular cement substance as the result of thyroid deficiency. Such a condition, if it exists, must have important consequences in the nasal epithelium, the integrity and impermeability of which is regarded as the first line of defense against pathogenic organisms. If such a weakened intercellular substance were to permit even occasional bacteria to enter which would have to be dealt with by the underlying secondary defenses it might well result in the low-grade inflammatory reaction which I have described as a "chapped" membrane.

Means states further that "while the thyroid hormone increases the demand for oxygen by the tissues, it likewise provides the wherewithal for this demand to be satisfied" (extra blood supply by more rapid heart action, increased stroke volume of the heart, peripheral vascular dilatation). Conversely it is known that when oxygen consumption, and therefore heat production, is reduced body temperature is maintained by shutting down the heat loss: peripheral circulation is reduced, sweating stops, muscular activity is slowed

down.[5] This is all very well in the skin, but the nasal circulation and moisture are required to protect the lung, and its muscular tone to keep the airways open. If these fail, then part of the burden of air-conditioning falls upon the bronchial tree and a situation approximating that of a tracheotomized person ensues. Cone[4] observes that the nasal temperature in hyperthyroidism averages 1.6° C. below the normal.

While the human integument is largely protected by clothing and even the exposed portions, including the lips, ears and eyes, are in a more or less casual relationship to environmental irritations, the nose is constantly subjected to air currents which bombard the mucosa with foreign matter day and night. As a consequence there are always casualties among the epithelial cells, requiring replacement. If this regenerative process is impaired through deficiency of thyroid hormone the result may well be the "chapped" condition described.

The other low thyroid effects, reduced peripheral circulation, lack of tone, increased permeability of the intercellular cement substance could account for the pale, wet type.

Whether this pale type, which is usually more pronounced than the other, represents a more advanced stage or is only the result of preponderance of one influence or another of the hypothyroid effect is not revealed by the cases in this series. The average basal metabolic rate of individuals with pale membranes was only 4 per cent lower than those with red ones (–21.6 per cent to –17.5 per cent). This may not represent the true difference, however, since some of the membranes designated as red were so violently red as to have possibly resulted from other causes.

Often the departure from normal is one of behavior rather than one of physical change or appearance. At this stage laboratory methods are no more helpful than statistics. Sections of nasal mucosa were made and proved disappointing. As might be expected, they showed only minor chronic inflammatory changes. Cilia were often present, but the surface epithelial cells were in general unhealthy.

Chavanne,[2] in 1936, injected thyroxin into the circulation of a dog and demonstrated a drop in the weight of the nasal secretions for a short period. This could be repeated at will. Unfortunately a second dog failed to react in like manner. He then removed the thyroid glands from these two dogs, increasing the nasal drainage which could again be held in check by the injection of thyroxin.

Animal experiments have not been done by us simply because no method suggests itself by which conditions encountered in the clinic can be reproduced. Total thyroidectomy obviously will not serve. Partial thyroidectomy fails because the remaining tissue undergoes hyperplasia, preventing a fall in the metabolic rate.

Most informative have been the selected cases referred to,—those known to be deficient in thyroid hormone, free from purulent sinusitis, atrophic rhinitis, occupational irritants, polyps and demonstrable allergies. These range all the way from a dry, uncomfortable nose in an old woman to a bloody, ulcerated membrane incapacitating a college student in whom all manner of local and supportive treatment had failed.

At present writing evidence of characteristic changes in the nasal mucosa arising from thyroid insufficiency rests upon three observations:

1. That in 87 per cent of cases suspected of such deficiency on the basis of nasal findings alone, a subnormal metabolic rate has actually been present,

2. That a high percentage of cases show unquestionable response to specific therapy, and

3. That in selected uncomplicated cases pronounced improvement followed treatment with thyroid substance alone after other means had failed, relapse occurring when the medication was withdrawn.

Quite probably the influence of the thyroid in many of these cases is modified by the activity of the related glands, more particularly the adrenal and the pituitary. Although recent comprehensive reports on Adrenocorticotrophin (ACTH)[13] and

Cortisone[6] make no mention of the nasal mucosa, there can be little doubt that this highly neurovascular tissue reacts similarly to others described and that the hormones of the thyroid and the adrenal cortex, here as elsewhere, are antagonistic to one another. This may account for those cases in our series which, though having apparently the same characteristics as the rest, failed to respond to thyroid extract.

Recognition of this condition depends at present chiefly upon the awareness of the rhinologist of its existence. Variable and vague though the symptomatology may be, the diagnosis is simple. A low basal rate is presumptive evidence; a therapeutic test conclusive.

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Beaumont Building.

THE TREATMENT OF SURGICAL SHOCK.*

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In a review of 32,000 anesthetics given by our group in the past eight years we have on record only one case within your specialty requiring such therapy. This may be because so many of your major procedures are performed under local methods; hence, we do not see all of your work. Otolaryngological surgery is slowly changing. Radical head and neck surgery is being performed by your specialty so that more and more men are being confronted by the problem of surgical shock. Similarly, extensive plastic surgery is being perfected. While these are not particularly shocking procedures, they frequently involve a long anesthetic which may predispose to shock and necessitate preventive and therapeutic shock measures. Be that as it may, surgical shock can and will appear when least expected and for this reason everyone practicing medicine must be ever aware of its treatment.

Shock is a disturbance of fluid balance resulting in a peripheral circulatory deficiency which is manifest by a decreased volume of blood, reduced volume flow, hemoconcentration and renal functional deficiency. Capillary tonus and contractility are controlled by levels of oxygen need and metabolic activity. Anoxia, toxins and the products of metabolism produce relaxation and increased capillary permeability, thereby giving rise to more endothelial surface by opening more capillary beds. Fresh arterial blood contains a hormonal substance, probably arising from the pituitary gland, which causes capillary contraction. Control of the circulatory cycle of the capillary bed is thus maintained in direct proportion to the functional

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activity of the cells supplied. This is the most important physiologic concept to remember in shock. The patient literally bleeds into his own capillary beds, causing a disparity between the blood volume and the vascular bed.

Shock has been classified on an etiologic basis into three types: hematogenic, neurogenic and vasogenic. Hematogenic shock is characterized by loss of circulating blood volume, neurogenic shock by reflex loss of vasomotor control, and vasogenic shock by dilatation of capillary vessels through the direct action of toxins on their walls. Two mechanisms, then, may produce shock: increased intravascular space, or loss of circulating blood volume with hemoconcentration. The former is primary, the latter secondary shock.

Primary shock is best exemplified in syncope, or fainting, where sudden loss of vasomotor tone with reflex slowing of the heart results from sudden painful physical or psychogenic stimuli. It is generally of short duration and recovery results from spontaneous return of the sympathetic vasomotor control. The arterioles and capillaries dilate suddenly, producing a tremendous increase in intravascular space. This type of shock is seen when local anesthetic agents are too rapidly absorbed or unintentionally injected into the blood stream.

These occurrences are quite common, and a brief word concerning their care and prevention might not be amiss. Fainting from any cause needs little therapy. Lowering the head, smelling salts and release of binding clothing are sufficient. The main therapy is prevention. This is done by reassurance and telling the patient when and if a certain procedure is to be painful. For our convenience instruments are often placed so as to present a terrifying picture to the patient. Any simple method of rendering them less conspicuous alleviates this problem. The patient who has absorbed too much local or received an accidental intravenous injection requires more care. An intravenous barbiturate injected early will quickly calm the garrulous and excitable patient and also provide protection against more serious reactions such as convulsions. In these more serious cases oxygen inhalations are essential as death results from anoxia. An intravenous barbiturate, suc-

tion and a mechanical airway should be available immediately whenever local anesthetics are being used in the care of a patient.

In secondary shock depletion of blood volume, regardless of the cause, is the initiating mechanism. Circulatory failure results from diminished cardiac output due directly to an inadequate venous return. Peripheral arterial resistance may be adequate to maintain blood pressure for some time in spite of an obviously failing venous return. Eventually this peripheral resistance will weaken and the blood pressure may then fall precipitously. All this time the capillary bed is opening up more and more channels, literally swallowing the erythrocytes; capillary stasis follows; anoxia occurs, causing further capillary beds to open. The capillary dilatation, the anoxia, the slow flow of blood, the lowered blood pressure all tend to initiate a vicious cycle, which if not stopped will surely and unrelentingly lead to death. Lowered metabolism and acidosis develop slowly and parallel the systolic blood pressure. The kidney function is deranged in shock. There is a reduction of blood flow and hemoconcentration, which the body resists by retaining fluid rather than letting it filter through the kidneys. Some patients, apparently well recovered from shock, die in uremia from failure of the kidneys to function properly after the shock.

Surgical shock, whether occurring during or after surgery, results from the combined effects of the disease, necessitating surgery, the anesthetic, the absorption of substances from damaged tissue, hemorrhage, and fluid loss from the surgical area. The emotional response of the patient is an important initiating stimulus. Last, but not least, the judgment, and skill of the surgeon and the anesthetist are important contributory stimuli. Surgical shock, then, includes both primary and secondary shock and is a combination of the three etiologic types: hematogenic, neurogenic and vasogenic.

Dr. Crile made a most astute observation when he said, "The best treatment for shock is prevention." This holds true to the letter and, fortunately, such practice is most common today. Preventive care is preoperative care. Serious attention

is given to nutrition and general health even weeks before surgery. Minor ailments and dietary deficiencies are corrected. Anemia is treated, even to the extent of several transfusions, days before surgery. Patients are frequently hospitalized well beforehand to attend to proper nutrition, hydration and medication prior to operation. In emergencies, shock is treated first so that the individual can better withstand the insult of surgery. The better the physical condition of the patient, the smoother will be the operative and postoperative period.

Before coming to surgery proper premedication is essential to allay apprehension, worry, fear and anxiety. A well-premedicated patient is a far safer operative risk. Proper acquaintance and judgment in handling such medication is essential as overdosage may play a part in the development of shock through depression and anoxia.

During surgery, trauma and fluid loss should be kept to a minimum; anesthesia should be neither too light nor too profound. When surgery of any magnitude or duration is contemplated, intravenous fluid should be given from the onset; not so much because of its need, but rather so that in case of emergency a ready portal of entry for immediate replacement therapy is instantly available. Blood, plasma or some suitable replacement should be attainable within a short period of time. These precautions, so universal today, have resulted in a marked decrease in the occurrence of shock during surgery or its immediate postoperative course.

Now, if surgical shock does appear, how is the condition to be treated? Here the judgment of the surgeon and the anesthetist plays a rôle of prime importance. The cause for the onset of the condition must be ascertained at once. Is it due to the anesthetic, reflex phenomena from surgical manipulation, fluid loss, gross or concealed hemorrhages, or to the disease for which surgery is being done? Occasionally one cause can be identified as the predominate stimulus, but by and large the inciting factor is a well amalgamated combination of stimuli. The important part of treatment is early recognition

and instant active therapy to reverse the physiological changes taking place, for as shock progresses its treatment becomes increasingly difficult. Because of the inefficient circulatory system, it is imperative that replacement fluids be introduced directly into the blood stream, either by intravenous or bone marrow injections. Generally speaking, the more closely the fluid given resembles that which has been lost, the more satisfactory the effect.

Intravenous fluids in the form of electrolytes are only mildly satisfactory. If the shock is early, if it is due to anesthesia, or if no better replacement is available, they are useful as temporary measures and generally are used to supplement the daily fluid supply. As a rule, surgical patients are deprived of fluids for eight hours preoperatively; hence, their need for fluid. Their value is mainly to maintain body hydration and as a preventive rather than a therapeutic agent. Such fluids leave the blood easily and cause only a temporary and transient increase in blood volume. Animals, experimentally bled or placed in severe shock, show no increase in survival rate when treated with the electrolytes as replacement fluids than those receiving no replacement whatsoever. Hence, such fluids are used mainly as preventive measures, or in early treatment while awaiting the arrival of more satisfactory replenishments for the blood volume.

In the majority of cases of clinical shock, plasma or blood is necessary for effective restoration of the circulatory deficiency. If little whole blood has been lost, plasma is the obvious choice for replacement. The amount to be given is not dependent upon any calculable formula or routine, but must be given until the patient has returned to a satisfactory condition. Plasma comes in frozen, liquid or dried forms, all of which are equally effective and completely interchangeable. Little time is utilized in preparing the solution and no tests are necessary before it can be administered. Its use has fallen into some disrepute because of the occurrence of a significant number of cases of homologous serum hepatitis. Plasma is prepared from pools, and one donor can infect the entire lot; however, where active therapy is needed, treatment should be

given in spite of the chance of this complication. Experimentally, animals placed in lethal shock, either from hemorrhage or trauma, show nearly as high rate of recovery as those treated with whole blood. This is especially true in animals when the shock was caused by trauma. The rationale behind the use of plasma is obvious:

1. It restores the blood volume by the same type of fluid that was lost.
2. It does not escape into the tissue readily unless considerable endothelial damage has occurred.
3. It exerts a normal type of osmotic pressure tending to draw fluid back from the tissues into the blood stream, thereby counteracting the mechanism by which shock progresses.
4. It restores directly and immediately the plasma protein deficiency which follows incident to shock.

In hemorrhagic shock whole blood is the most logical and efficient replacement fluid. The amount to be utilized depends upon the amount lost and upon the patient's response to replacement. Most failures in treatment are due to inadequate refilling of the vascular bed. Too many doctors tend to sit back and relax after a patient has had one transfusion. Replacement must continue until the blood pressure, pulse, color and hematocrit determination are back to normal levels. Treatment must not be discontinued as soon as a normal state is approached, as often there is a compensatory rise, even above normal levels, which may be followed by a return to the shock state unless therapy is watchfully continued. In other words, the activity of treatment can be diminished, but should not be terminated until the normal state has been maintained for a considerable period. In some instances of hemorrhagic shock, surgical intervention may be the only method of terminating the hemorrhage. Enormous quantities of blood may be necessitated and such quantities can, and should, be given. The patient should receive blood until he is out of the shock state before he is taken to surgery and should continue to have it until surgery is completed. This is perhaps one of the great-

est lessons learned in the last war. Plasma can be used along with the blood, or as a temporary substitute, so long as no more than 1 liter is given. In hemorrhagic conditions an overdosage of plasma may result in permanent hemodilution, secondary anemia and diminished oxygen carrying power of the blood.

In giving fluids, certain routine measures should always be followed. A vein should be chosen which is accessible, yet which will permit the patient some freedom of motion and allow free movement of the patient with little danger of its dislodging and infiltrating the surrounding tissue. The needle and tubing should be fitted firmly in place. The needle should be of sufficient size so that any replacement fluid can flow easily and quickly through it. The usual size is either an 18 or 19 gauge. Such precautions allow for permanence and for rapid or slow flow of the fluid. In extreme cases a larger needle with a trocar can be introduced into the vein, either directly or by surgical cutdown. Such a needle can be left in place as long as necessary. The speed of replacement is important. If shock is severe, one pint of blood or fluid can be injected in from three to five minutes, while following fluids can be allowed to enter at a variable rate, depending upon the patient's response.

The giving of transfusions of blood is more complicated than giving other fluids as the matter of blood types occurs. If the need for transfusion is anticipated, this, of course, presents no problem as the proper type blood will be ready in surgery. If the need of some is foreseen in surgery, it can usually be ordered well in advance, so that the laboratory can have it ready. If emergency need should arise, however, type O blood, that is, RH — can be given to females and type O — RH+ to males. In many large clinics and institutions this procedure is frequently almost routine and the incidence of reactions is small. Transfusion reaction is on the decline, but if symptoms or signs should occur, the transfusion should be stopped immediately.

The importance of the use of oxygen inhalations cannot be overemphasized in the treatment of circulatory deficiency. In

oxygen deficiency there is a decrease in alkali reserve with a resulting slide toward acidosis. Oxygen lack results in incomplete combustion and the formation of abnormal catabolic products. This gives a disturbed electrolytic balance between the cells and the extra cellular fluid. Most important, lack of oxygen relaxes and renders more permeable the capillary endothelium. This produces a self-perpetuating chain of events, causing the circulatory deficiency to progress in the manner of a vicious cycle. With these considerations in mind, it is little wonder that the value of oxygen in the treatment of shock is being stressed more and more. Experimentally, dogs in shock maintain their blood pressure at a higher level and live longer if given oxygen inhalation. Similarly, animals given oxygen inhalations tolerate more severe hemorrhages than do the controls. Oxygen can be given via tent, mask or catheter. Of all methods, the catheter is perhaps most comfortable and efficacious. If under anesthesia, the patient is given pure oxygen with no anesthetic agent. Its simplicity of administration and its availability make it the easiest form of medication in shock, but unfortunately the most neglected. No case treated for shock is being treated adequately unless oxygen is administered immediately. It is frequently the first treatment received because of its instant availability.

Any other treatment of shock is of little value. Drugs, by and large, are of little avail. Adrenalin-like drugs, especially ephedrine or neosynephrine, are of use in cases of shock due to spinal anesthesia and possibly in very early shock. Adrenalin is contraindicated. The circulatory system is already in a state of extreme vasoconstriction down to the finest arterioles, hence the use of these drugs is needless; in fact, shock can be induced by repeated use of such drugs. The function of the adrenal cortical hormone is to maintain the normal impermeability of the endothelium and the cells. The use of eschatin, a cortical extract, or synthetic desoxycorticosterone may have some use. Such use would be mainly preventive as experimental evidence shows that its use may make animals more impervious to shock. Stimulants and analeptics have been used, but the rationale behind their use is not evident. They

in no way affect the tonus or permeability of the capillaries nor do they increase the efficacy of a failing circulation.

Mechanical methods to facilitate the return flow of venous blood from the periphery have been tried. The reasoning behind such action is not sound, as the stagnation of blood is not on the venous side but rather in the capillaries. External pressure or gravity have no effect upon the capillary bed.

There are several available substitutes for blood or plasma that are quite efficacious and produce prolonged effects. Such replacements can be advantageously utilized if the desired replacements are unavailable immediately. In mild cases, their use alone may be satisfactory treatment. To be satisfactory as a blood or plasma substitute, a fluid must meet certain definite specifications. Its molecular size must be such that it will not escape from the vessels. Its viscosity and osmotic pressure must approach those of blood. It should be isotonic with the contents of the erythrocytes. It must be nonantigenic and innocuous. Of the innumerable substitutes that have been presented, those proving most efficacious have been acacia, pectin, peristan and dextran. Gum acacia, the oldest, given in physiologic saline is well tolerated and has definite beneficial effects; however, it has caused serious reactions and is not readily eliminated, forming deposits in the liver and spleen. Pectin, an acid derivative of citrus fruits, was introduced in 1941. It is nontoxic and nonantigenic, and well handled by the system, being eliminated within 72 hours. While it causes some pseudoagglutination of the erythrocytes, its value more than compensates for this. Partisan is a synthetic polyvenyl pyrollidin developed by the Germans and used extensively by them in World War II when they could not supply sufficient amounts of blood or plasma for their wounded. It is inactive in the body, remains actively in the circulation for two or three days, and is completely eliminated. Only one case of drug reaction has been reported after thousands of instances of its use. The newest, and probably what will be recognized as the best substitute is dextran, a product of Swedish research. It is a polysaccharid of high molecular weight. It is used in a 6 per cent solution in normal saline. It is eliminated

slowly over a five-day period, giving a prolonged period of action. No drug reactions of any severity have been noted following its use. These substitutes are only substitutes, and in cases not showing immediate results all efforts should be made to obtain blood or plasma.

Shock is a state of circulatory deficiency, which, if not treated at its very onset and treated diligently, will progress steadily and relentlessly to a fatal ending. Its treatment consists in the main in adequately replenishing the circulating blood volume with blood, plasma or a substitute while concomitantly furnishing oxygen to oxygenate the blood adequately. If these two factors of treatment are carried out with watchful care, the shock will generally be reversed and a satisfactory outcome will follow.

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ALLERGY — EFFECTIVE TREATMENTS USED IN OTOLARYNGOLOGY.*

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Otolaryngologists need a simple, practical program by which they may successfully treat their allergic patients. In the main, the procedures recommended in this paper have been used by me for my nonseasonal allergic patients over the past 30 years. Their greatest value lies in their simplicity and their effectiveness. Most patients who have recurrent attacks of sinusitis can be permanently cured. For some patients who have chronic sinusitis, sinus surgery will still be necessary. Even for the diminishing number of patients who require sinus surgery there is an added assurance of permanent good health if antiallergic procedures are used following their operation.

There is a popular expression, "Once a sinus patient, always a sinus patient." Perhaps this has been true in the past, but at present it is definitely false. When there is intelligent cooperation by patients in helping to cure their allergies and indicated surgery its expertly performed, most protracted cases of sinusitis can be permanently cured.

We must accept as a fact that the incidence of sinus surgery has decreased. This decrease had started before the use of sulfa drugs and antibiotics. In fact, these newer drugs have been somewhat disappointing in their effects on chronic sinusitis. The decrease in the number of operations on the sinuses was due to several causes. Dissatisfaction with the results obtained by surgery was felt by both patient and doctor. Ill advised or inadequately performed surgery caused patient

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dissatisfaction. Failure to recognize allergy as a cause of recurrent sinusitis led to repeated operations.

Allergy is now becoming generally recognized as a most important cause of sinusitis, and the successful treatment of allergies has had its effect in the lessened need for sinus surgery. Until recent years, however, the importance of that relationship was not generally recognized. It should again be emphasized that proper care of the allergic patient in the future will still further reduce the need for sinus surgery. The effectiveness of our effort to prevent sinusitis will depend upon the alertness of the otolaryngologist in recognizing diagnostic symptoms of allergy and his efficiency in treating the cause. We must not only be alert to the allergic causes of symptoms but we must also recognize the proper time for surgical intervention. In order to prevent recurrences of sinusitis following operations on the sinuses, we must also cure the allergies which caused the recurrence of symptoms.

I have tried many methods in order to create a satisfactory diagnostic and treatment policy over these many years. Experience has convinced me that the otolaryngologist who has been adequately trained in the diagnosis and treatment of allergy will obtain the greatest percentage of permanent cures for his nonseasonal allergic patients. The next most effective arrangement is through an association with an allergist on an equality basis. Such an arrangement is apt to prove unsatisfactory if either the otolaryngologist or the allergist is in a position subordinate to the other.

My total program for the care of an allergic patient can be outlined as follows:

1. Dietary Selection.

2. General Health Measures.

3. Correction of Emotional Instability.

4. Immunization and Antihistaminic Drugs.

5. Elimination of Contacts.

6. Surgery.

The combined use of these six methods has produced maximum results. Nos. 1, 2, 4 and 5 will be discussed in this paper.

Food is the most important single cause of allergy in those patients who have consulted me as an otolaryngologist. Of course, I am aware that this statement is contrary to the respected opinions of other authorities. Because I believe most patients who consult the otolaryngologist regarding their symptoms are food-sensitive patients, the subject of proper food selection will be the major theme in my presentation. Again I must state that I am limiting my remarks to non-seasonal allergy.

The allergic ingestants are usually of a retiring nature and in this respect they differ radically from the seasonal allergies characterized by dramatic explosions. Likewise, in using skin tests for diagnosis, the foods respond in an unpredictable manner, while skin tests for the seasonal varieties are more reliable. Food allergies are generally more difficult to detect. The most useful method of determining which foods are responsible for symptoms is a clinical one. The purpose of selecting foods ordinarily believed innocuous when ingested is to relieve the symptoms caused by other foods as soon as possible. Always recommend allergen-poor foods in adequate amounts and variety in order to completely fill the nutritional, vitamin, mineral and appetizing requirements. All patients must have a balanced, attractive diet in the beginning. Later, any foods the patient will tolerate are added. Any supplements to the original diet are made after a six weeks symptom-free period. If one must attach a name to this policy, "A Dietary Selection Method for Diagnosis and Treatment" might be appropriate. In addition to my own experience in choosing proper foods, I have made free use of information published by such authorities as Rowe, Vaughn and Hansel, and the personally communicated contributions of Blake F. Donaldson. One of the greatest hindrances to a proper diet selection is the unreliability of lists based on skin reactions. New lists must be made designating foods which cause clinical reactions. Such a list should also include the symptoms caused by each food. A new list is under process of compilation by

me which will be based on clinical reactions. There is great need of many such long-range reports. The greatest difficulty seems to be a differentiation between allergic reactions and indigestion. There is some evidence to indicate that an allergic reaction is one and the same with indigestion. Strangely enough, the tables of foods causing complaints which have been mentioned in McLester's "Nutrition and Diet in Health and Disease" parallel closely the usual lists of foods which cause allergic reactions (Tables 5, page 145; 6, page 146; 7 and 8, page 147; and Table 9, page 148). Practically all the foods named by McLester as causing indigestion may also be classed as allergic.

The title "Selective Diet" indicates a positive approach and does not carry the inference of deprivation. This simple method recommends one complete diet selected primarily because of its food safety and, second, its clinical adequacy. According to an increasing number of authorities, such a diet should be of a high-protein type. The selection of a proper protein now becomes important.

Quoting Norman S. Moore, of Cornell University, in his article, "Facts About Nutrition," *New York State Journal of Medicine*, May 1, 1950, "Overall resistance to infectious diseases, which is, after all, the subject of most practical concern to the physician, appears to depend upon adequate nutrition, and especially protein nutrition." To quote again from McLester's "Nutrition and Diet in Health and Disease, page 188, year 1949, "Meat takes a prominent place in the dietary because of its flavor, the stimulating influence of its extracts and the high biologic value of its proteins. As a good source of vitamins also, notably thiamine and riboflavin, it is receiving increasing recognition . . . the conclusion there reached that 100 gm. of protein, more or less, represents the optimum daily intake for the average adult."

Three main sources of protein are available, *i.e.*, eggs, milk and meat. The relative values of these proteins are stated by McLester ("Nutrition in Health and Disease," page 188, year 1949): "The proteins of meat are surpassed in nutritive quality only by those of milk: they are equalled by the protein of

eggs." The proteins of milk and eggs are not available for our use because these foods stand first in the list of allergic food offenders. Fortunately, we are still able to use the highly satisfactory meat protein as a basis for our "Selected Diet" for allergic patients. We have selected meat protein as the foundation on which to build our diet, and we have ample authority to warrant the statement that we are on sound therapeutic ground. Pork and beef are occasional causes of allergic reactions, and these meats must sometimes be replaced by fowl or fish proteins. No meat causes symptoms as frequently as eggs or milk. Other nonallergic foods are grouped around meat in order to furnish a diet with adequate calories, vitamins and minerals. Believing that appetite and a zest for food is an important factor in proper nutrition, a variety of attractive foods is selected. Meat with its normal fat is the main part of each of the three daily meals.

At the end of a six weeks symptom-free period, foods are constantly added. If any food produces a recurrence of symptoms, that food is again removed from the diet. Six weeks to two months later the same food is again added, and if there is a recurrence of symptoms, that food is permanently removed from the diet.

Another method is occasionally tried in which forced feeding of some individual food is ordered in order to precipitate an attack. In case an attack is precipitated, the food is removed and a similar procedure is again tried at a later date. The occurrence of a second attack following ingestion prohibits further use of the offending food. The following list of foods is grouped according to the degree in which they are responsible for allergic reaction. This list is under constant revision and the changes are based on clinical experience.

All authorities agree on certain foods as being the ones most apt to cause allergic symptoms. These foods are:

1. Milk and milk products.

2. Wheat and wheat products.

3. Eggs.

FOOD LIST.

H	A	L
Wheat	Barley (Malt)	Rye (Ry-Krisp, Horlamus Rye Bread)
Onion	Corn (Karo Syrup, Mazola Oil)	Oats
Garlic	Bananas	Rice, Wild Rice
Leek	Asparagus	Popcorn
Turnip and Rutabaga	Cornstarch	Sorghum, Cane Sugar
Cabbage and Kale	Rhubarb	Tapioca
Mustard	Buckwheat	Cocoanut
Radish	Spinach	Date
Nuts	Cauliflower, Broccoli	Oleomargarine (Gold Dot)
Strawberry	Brussels Sprouts	Pineapple
Apple	Kohlrabi	Mulberry
Orange	Horse Radish	Fig
Cottonseed	Quince	Chard—Swiss
Chocolate-Cocoa	Pear	Chard—Kale
Spices and Seasonings	Peach	Beet
Tomato	Nectarine	Currant, Gooseberry
Peppers	Apricot	Raspberry, Blackberry
Cucumber	Lentil	Dewberry, Loganberry
Watermelon	Bean	Plum, Cherry
Cantaloup	Tangerine	Water Cress
Pepper (black and white)	Grape	Lentil, Bean
Honey	Raisins	Soy Bean
Eggs	Grape Vinegar	Olive
Ice Cream	Okra Gumbo	Lemon
Clam	Celery	Grapefruit
Lobster	Irish Potato	Lime
Shrimp	Eggplant	Sugar—Maple
Prawn	Chichle	Tea
Crab	Mussell	Carrot (vit. A high)
Pork, fresh or smoked	Scallops	Parsnip
Beef, Veal		Parsley
Jello contains pork and beef		Avocado (Alligator Pears)
Milk (small amount of allergin in butter)		Huckleberry
Cheese. Milk allergins may tolerate cheese		Cranberry
		Sweet Potato—Yams
		Squash, Pumpkin, Gourd
		Lettuce, Endive, Chicory
		Salsify (Oyster Plant)
		Artichoke
		Dandelion
		Guava, Vanilla
		Oyster
		Soy Products

Legend:
H = a **high** percentage of allergic reaction.
A = an **average** percentage of allergic reaction.
L = a **low** percentage of allergic reaction.

4. Shell fish.

5. Chocolate.

6. Nuts.

Such foods must be completely eliminated during the trial diagnostic period. They may be tried singly in large amounts as a diagnostic procedure.

The list of foods now recommended for the trial diagnostic period is the same list which is used for treatment.

HIGH PROTEIN MEAT DIET.

Meats: Meat is to be eaten three times a day. Pork, beef, veal, lamb, mutton and liver (three meals a week with kidneys or sweetbreads as occasional alternates). No smoked or processed meats. No fowl or fish.

Vegetables: Sweet potatoes, raw carrots, beets, artichokes, and alligator pears, brown rice and wild rice, soy beans.

Fruits in Season: Grapefruit and lemon, lime, dates, figs, dried prunes, dried apricots, pears, plums.

Tapioca.

Fluids: Tea with lemon and sugar, lemonade, water between meals.

HIGH PROTEIN MEAT DIET (SUPPLEMENTED).

Vegetables: Irish potatoes, broccoli, swiss chard, lentils, squash, oyster plant, endive, chicory, romaine.

Fruits in Season: Pineapple (canned or fresh), cherries (canned or fresh), peaches (canned).

Berries: Raspberries, blackberries, huckleberries, cranberries, currants, gooseberries.

Melons (in season).

Maple syrup or corn syrup.

Fluids: Coffee (black, one cup daily).

Dressing for salad: *Apple* cider vinegar with sugar. Alternate: Pure olive oil or sesame oil, apple cider vinegar, salt and pepper. Mix salt and pepper with vinegar. To one part of the vinegar mixture add two parts of olive oil or sesame oil. Whip until creamy.

HIGH PROTEIN FIN FISH AND POULTRY DIET.

Foods selected for the trial diagnostic period permit:

Meat: Lamb and mutton (kidneys included).

Poultry: Chicken, turkey and duck. (Livers and giblets frequently.)

Fin Fish: (Particularly herring, salmon, mackerel and sardines in *pure* olive oil.)

Vegetables: Sweet potatoes, raw carrots, beets, artichokes, and alligator pears, brown rice, wild rice, and soy beans.

Fruits in Season: Grapefruit and lemon, lime, dates, figs, dried prunes, dried apricots, pears, plums.

Tapioca.

Fluids: Tea with lemon and sugar, lemonade, water between meals.

HIGH PROTEIN FIN FISH AND POULTRY ALTERNATE (SUPPLEMENT)

Meat, Poultry, Fin Fish: See high protein fin fish and poultry diet.

Vegetables, Fruits and Berries: See supplement of high protein meat diet.

Fluids: Coffee, black, one cup daily.

The use of this diet represents a return to eating simple, basic foods which have been properly prepared. Unfortunately, our modern conception of a proper diet envisions eating a piece of "needled" toast and a cup of coffee for breakfast, a counter sandwich for lunch, and a "chocolate malted" before a salad and ice cream dinner. Attractive,

simple, nutritious foods are considered as a radical departure from normal. To induce a large (or small) patient to accept simple foods requires the efforts of a doctor with real sales ability. Unfortunately, foods that are considered "body builders" and "foods that are good for you" are overused today. These same foods by odd fact are also the most frequent "poisoners" of those people who are food sensitive or allergic. So-called nourishing foods are actually forced on our undernourished school children by a mechanized and misguided school dietary program. The undernourishment of children is ofttimes due to forced ingestion of milk which *for them* is a poison. Unfortunately, when any doctor suggests that these personal poisons be removed from the diet, there is an immediate resistance by all parties concerned. If a youngster is forbidden to eat a personally favored food, he may be placed at the head of the resistance list as a most strenuous objector.

Food sensitive youngsters are frequently thin, "pasty faced," nervous, pampered, highly emotional, and hopeless "spoiled brats." They "catch" one cold after another. If your salesmanship is successful and your program is followed, these same rebellious patients will become most agreeable collaborators. In addition to the improvement in personality, they acquire a normal health. Such results will be among your most gratifying experiences.

To summarize statements about food:

1. Select those foods for the diet which are infrequent causes of clinical allergy.

2. All meals must consist largely of the high-protein food, meat. A meat diet will increase energy.

3. The daily vitamin and mineral intake must be adequate.

4. The caloric values can be adjusted to maintain, increase or decrease weight.

5. A variety of food must be properly prepared and appear appetizing.

GENERAL HEALTH MEASURE.

One issue cannot be dodged. Many people are sensitive to tobacco and some are sensitive to alcoholic drinks. Patients who will abstain from liquor and tobacco during the six weeks' trial diagnostic period will do better than those who will not. The relation of alcoholic drinks to allergy is of less importance than tobacco. There is one conclusive test which individuals who may be allergic to tobacco can try. Abstain from all smoking for six weeks and honestly compare your trial period with the previous six weeks' period. Answer yourself honestly regarding the result. Some people can smoke with apparent impunity while others cannot. Cigarettes seem to be the worst offenders. I doubt that anyone would claim an improvement in health because of smoking. Rarely is it possible to benefit by "cutting it down." To get results you must "cut it out."

People afflicted with perennial allergies seem to be those who have insufficient exercise "out-of-doors." Many methods of daily exercise have been tried for urbanites and walking works the best of all. A two-mile daily walk completed before breakfast will do wonders for those patients who live physically inactive lives.

IMMUNIZATION AND DRUGS AFFECTING THE VASOMOTOR MECHANISM.

The methods advocated by Hansel (Hansel, F. K.: Some Experiences with Small Dosage Dust and Pollen Therapy, *Southern Medical Journal*, 38:608, 1945) and also employed by Ashley (Ashley, Rea E.: Dust Therapy in Allergy of the Ear, Nose and Throat, *Annals of Otolaryngology*, 58:417-428, 1949) have been used by me with success. The intradermal skin tests are done with a 1:1,000,000 dilution of Hansel's dust and a 1:1,000,000 dilution of histamine. Following their practice, I also use the skin tests to regulate dosage for the hypersensitive patients rather than as a determination to use or not to use the treatments.

Drugs affecting the vasomotor mechanism have been used with success.

Physical allergy remains as an unsolved problem. Under this heading are grouped those unfortunates known as "draft sensitive" people. They may have suffered some sort of trauma to their heat-regulating mechanism which fails to accommodate for temperature changes. The air-conditioned buildings are unbearable for those people who suffer from physical allergy. Air-conditioning systems using refrigeration cause the most trouble, and those using humidification and dehumidification through a blower are only a little less troublesome. Electric fans will precipitate the usual distressing head symptoms. Changes in temperature when people go from one room to another as well as temperature changes encountered on entering and leaving the water while bathing may cause an onset of symptoms. Histamine immunization plus avoidance is the only hope for these maligned, "fussy" people, as of today.

ELIMINATION OF CONTACTS.

Proper preparation of the living quarters, particularly the bedroom, will eliminate many of the causes of allergy, especially among the inhalants.

The following articles should be removed from living contacts: rugs, carpets, overstuffed furniture, pets, flowers, cosmetics and toilet water.

Pillow and *mattress* must be allergin-free or have allergin-proof covers. *Rooms to be cleansed* with either a vacuum cleaner or with a wet rag. *No cosmetics* are to be used. This includes face cosmetics, powders, toilet water, perfumes and preparations for the hair. There are allergin-free cosmetics available which may be used.

It seems necessary to include some comments on "history taking" combined with tact in the approach to our treatment. All alert doctors agree on the inestimable value of a comprehensive history in making a diagnosis of allergy. History taking is the first, most important, and indispensable step. A history must be thorough and complete. In obtaining a proper history, perseverance and patience plus a sincere effort

must be used to obtain the friendly cooperation necessary for the best results. Children, especially, require a leisurely, tranquil, friendly approach by the doctor. The doctor must be calm and maintain self-control at all times. He must disregard the annoyance sometimes caused by parental interference. Once a confidential relationship between the smaller patient and the doctor has been established, it is agreeably surprising to see how complete the frankness and help of your patient can be. This faith and trust on the part of the patient will be most important when you must know of any deviation from dietary rules. All confessions of error must come from the patient, never from the parents in front of the child. This young patient will be deprived of many things he may particularly like, and for him this loss of desired and enjoyed foods will be a serious change in his pleasant living habits. First visits should be used to establish confidence on the part of a child and at the same time convince the parents of the benefits derived from a program which may seem to them like medical radicalism.

Being human, some parents bribe their children with tasty but forbidden foods such as ice cream, chocolate milk drinks, or nut candies. Even grandmother thinks it is smart to buy a grandchild's favor with some of the forbidden foods. Grandma's helpful comments to cover her misdeeds sometimes cause suspicion, and once the child's confidence and faith are lost, they are difficult to regain. Whenever it is possible, the doctor should talk with his little patients alone. He will be more apt to succeed in obtaining full and confidential cooperation. Minor misdemeanors on the part of the patient will then "come out in the wash."

This paper does not deal with symptoms or diagnosis. It is primarily concerned with the treatment of the allergic patient who consults the otolaryngologist. Case histories from my files would strengthen my contentions, but individual case histories are valueless and many such histories are a monotonous repetition of symptoms and methods. The types of cases which have responded in satisfactory numbers are recurrent colds, recurrent and chronic sinusitis, recurrent otitis media

and interna (Ménière's syndrome), headaches (including migraine), and the postnasal drip (catarrh). The complete program is presented for your consideration and trial. Thirty years ago the subject of allergy in otolaryngology was ridiculed. Today the modern otolaryngologist recognizes the fact that allergies are important causes of our ear, nose and throat diseases.

COMMENT.

In this paper I have claimed that patients who consult the otolaryngologists because of symptoms due to nonseasonal allergy can be most effectively treated by the otolaryngologist who is conversant with these methods of treatment. The treatments described can cure patients who have suffered from protracted or recurrent sinusitis and render most sinus surgery unnecessary. I have stated that some properly selected patients who have sinusitis require surgery. If such surgery is done by a competent otolaryngologist, who shall at the same time treat the underlying allergy, these patients also can be permanently cured.

I have outlined a program in which I have used a "Dietary Selection Method" for diagnosis and treatment of food allergies.

The need for better living regimes and a correction of an emotionally unstable personality have been given prominence in the treatment of allergies.

The discussion of desensitization has been limited to histamine and a comprehensive dust plus mould combination.

The conditions for which this program has been used successfully by me include the recurrent common cold, recurrent sinusitis, recurrent otitis media and interna, headaches, and postnasal drip.

CONCLUSIONS.

1. Drugs which have an effect on the vasomotor system are of greatest value in the symptomatic treatment of allergies.

2. Increasing numbers of permanent cures are being produced for those patients who have otorhinolaryngologic dis-

eases of allergic origin by proper diet selection, plus the elimination of environmental causes.*

3. A combination use of these two methods will produce the maximum in permanent cures for the allergic patient who consults the otorhinolaryngologist.

*Since this talk was delivered in San Francisco, I have found a product which, if it lives up to some of the statements that have been made, will eliminate the necessity for expensive and extensive room changes which are at present necessary in my program. The name of the product is DUST SEAL.† It is a material with which fabrics are treated to eliminate the damaging dust element.

†Arthur F. Coco, M.D., F.A.C.A. (Hon.), Pearl River, N. Y.: "Environmental Excitants of Idioblaptic Allergy (Inhalants)." Reprinted from Annals of Allergy, Volume 6, pp. 501-510, September-October, 1948.

"A CENTURY OF HEALTH PROGRESS" AT QUINCY, ILL., OCT. 13-17, 1950.

The Adams County Medical Society, a component part of the Illinois State Medical Society and the oldest county medical society in Illinois, is doing the unusual by sponsoring a great public celebration to commemorate the centennial of its foundation. The Society was formally organized on March 28, 1850, and has held regular meetings except for one year during the Civil War. The celebration, which will be a nonprofit affair, will be known as "A Century of Health Progress" and will depict the progress of medical science during the past century. The principal features planned are a large technical and educational exhibit hall, a spectacular, colorful pageant under professional direction, a spirited street parade, an educational motion picture theatre. Final plans have not been completed but call for the close cooperation of many of the civic organizations of Quincy in order to assure the success of the project. An estimated attendance of over 60,000 (not including the parade) from northeastern Missouri, southeastern Iowa and central western Illinois is anticipated.

The Society will be grateful for suggestions that will assure the success of the celebration. Dr. Harold Swanberg, W. C. U. Building, Quincy, Ill., is serving as general chairman, Adams County Medical Society Centennial Celebration.

DETERMINING FACTORS IN COMPOSING AND ANALYZING SPEECH-HEARING TESTS.*†

Part I: The Influence of Frequency Composition of the Speech Sounds on the Articulation Curves as Related to Pattern of Hearing Loss.

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In recent years renewed attention has been given to testing and appraising the hearing function by means of one or another form of speech-hearing test. The voluminous literature that has evolved attests to this awakened interest. Testing the hearing by means of the live voice was the first type of hearing test, and the interest and basic appreciation of the value of this kind of test was only temporarily interrupted by a rather enthusiastic swing to pure tone audiometry. For the clinician as well as for those interested in the purest form of physiological acoustics, for the educator as well as for those concerned with the applied aspects of aural rehabilitation by means of hearing aids, there should be no conflict or competition between the two methods of studying the hearing function.

Sensing the presence of pure tones at faint levels of loudness is not the same psychophysiological function as perceiving patterns of speech sounds of whatever composition at the various tolerable ranges of loudness and degrees of clarity of which the normal or pathological organism is capable.

*Read at the meeting of the Eastern Section, American Laryngological, Rhinological and Otological Society, Inc., New York, N. Y., Jan. 5, 1950.

†A study from the Department of Otolaryngology, Mt. Sinai Hospital, New York, N. Y.

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Pure tone audiometry is a sensitive probe of the delicate functioning of the hearing mechanism, and has a permanent and indispensable place in both the clinic and the laboratory; but it does not *measure* the ability to perceive human speech patterns, nor can one predict with certainty exactly how well an individual can perceive speech sounds from an inspection of the pure tone audiogram. If one is interested in the basic physiological condition of the hearing mechanism there is no better means of exploration than with pure tone audiometry with its vast complement of variations. If one is interested in the *perceptual capacities* of the hearing function, the most direct answer can be found by means of speech-hearing tests.

Extensive study of the various forms of speech-hearing tests has been made and reported during the past eight to 10 years. Electroacoustics has evolved to the point where the techniques of recording speech and controlling the performance of reproducers are rather common knowledge and excellent equipment for such purposes can be assembled rather readily. The time is here for developing standards in the field of speech-hearing tests. Physical standardization of equipment is no problem, but there remains considerable indecision as to the content of the speech-hearing tests themselves. The results from our study, using a unique type of speech-hearing test, are particularly timely, because they indicate quite clearly that distinctly different results can be obtained when due consideration is given to the frequency composition of the test words.

II. DATA AND EQUIPMENT.

The data upon which this report is based were drawn from tests that were given routinely to some 850 patients at the Ear, Nose and Throat Clinic of the Mt. Sinai Hospital, New York, during the period from March, 1947, through November, 1949. Approximately 200 of these patients had no significant impairment of hearing, hence their data were used as a normal reference in making comparisons with the data collected for the others who had varying degrees and patterns of hearing loss. In addition, a special prolonged series of tests were given to a selected group of the subjects with normal hearing, as judged from pure tone audiograms.

Both kinds of tests were given in a former treatment room, approximately 18 feet by 20 feet by 12 feet (ceiling), which was acoustically treated but not soundproofed by any means. A window-type air conditioner helped to maintain comfortable temperature during hot days, but this machine was necessarily cut off during the conduct of tests. The ambient noise level in the room under typical testing conditions ranged from 50 to 56 db. The acoustic seal provided by the earphone caps was definitely beneficial, therefore, because of this relatively high ambient noise level.

All patients included in this analysis were given complete pure tone audiometer tests by air and bone conduction with a standardized Maico Model E-1 Audiometer. Most of the air conduction audiograms included all of the 11 frequencies available on the audiometer, extending from 125 to 10,000 cycles. Bone conduction tests were made at each of the eight frequencies ranging from 125 to 4,000 cycles. A specially constructed and calibrated white noise generator was used for masking, when indicated.

In addition to the audiometer tests, all patients were given a new type of speech-hearing test (described later) using an Acousticon Model A-1 speech audiometer as the standardized reproducer. This instrument provides the means for controlling the transmission of test materials from either recordings or live voice sources to the listener by way of earphones (air conduction), free field (loudspeaker) or bone vibrators. Suitable controls on the instrument panel permit testing either ear separately or both ears simultaneously by air conduction. In the present tests, the ANBH-1 type earphones (double headset) with ear caps that provide a good acoustic seal were used throughout.

A monitoring meter and electroacoustic level control on the panel permits maintaining the acoustic output of the reproducers at predetermined calibration levels. A standard attenuator with a range of 50 db in steps of 5 db, with an auxiliary 55 db attenuation pad, provides a useful range of 105 db for the sound pressure level of the speech sounds. For all of the speech-hearing tests in this study the speech sounds were re-

produced from standardized recordings that were engineered at the Acousticon Laboratory. The master recording was made by the National Broadcasting Company, Inc., New York, by their standard orthacoustic method, and the printings were made on 10-inch laminated shellac discs. These records are played at 33-1/3 r.p.m., have a standard groove, and are played back with a 3 mm. stylus. The recording includes a 1,000 cycle test tone which is used for calibration purposes. A light weight pick-up arm and high quality variable reluctance cartridge with a permanent sapphire needle were used during the period of these tests.

The method of calibration which was in effect throughout our period of testing involved relating a value on the monitoring meter of the instrument to the sound pressure levels produced on a standard 6 cc. coupler designed for use with the ANBH-1 earphone. The procedure used for standard calibration was to set the amplifier gain so that the 1,000 cycle test frequency produced a steady sound pressure level of 130 db above 0.0002 dynes/cm^2 with the earphone in place on the 6 cc. coupler when the panel attenuator was set to give maximum output. The gain setting required was noted on the panel monitoring meter. This reading was used in the course of testing to maintain the acoustic output of the earphone at the required level. In addition to this reference calibration, readings were taken also with a standard V. U. meter connected across the output of an artificial ear to measure the sound pressure level in volume units (V. U.) delivered by one receiver on the 6 cc. coupler for each word employed in the speech-hearing test. These V. U. meter readings give a measure of the effective maximum sound pressure level of each test word. Since the words employed in this test are all of the consonant-vowel-consonant type, the V. U. readings are very nearly measures of the effective maximum sound pressure level of the *vowel* component of each word. The consonant components of each word range from about 5 to 32 db less than the interposed vowels. On this particular recording, the V. U. readings for individual words range from 121 to 129 db. Most of them concentrate in the range from 123 to 127 db. In plotting the results of the speech-hearing tests on the

charts included in this report, the average V. U. readings for the individual test words was used as the basic reference.

III. BEASLEY'S DIFFERENTIAL SPEECH-HEARING TEST.

The unique feature of this speech-hearing test is the critical frequency composition of the individual words and the manner of presenting and scoring the test material. All other speech-hearing tests of which the authors have knowledge include in any scored set as presented in a test an almost complete assortment of the vowel and consonant sounds that occur in a "randomized" order as the test proceeds. Such tests, when used with a standardized and calibrated instrument for reproducton, measure an individual's overall ability to perceive isolated words generally. The idea for a different type of speech-hearing test was worked out by Beasley during the period from 1939 to 1941, primarily as a result from the analysis of data collected during his nationwide study of deafness in the population in connection with the National Health Survey.[1,2]

In devising this test, immediate use was made initially of the detailed data given by Fletcher[3] on the energy *vs.* frequency composition of consonants and vowels and the influence on articulation ratings for the various individual sounds resulting from introducing high pass and low pass filters at various cutoffs into the transmission circuit. A detailed table was set up for all of the speech sounds and a rating scheme devised for selecting the most differentiating phonetic elements of speech sounds. As an entirely empirical result from this analysis, it was concluded that the energy-frequency spectrum can be differentiated in relation to the largest number of individual speech sounds in the region of 1,500 cycles. On this basis vowels and consonants were selected from the table to meet the following requirements:

1. Those that show the greatest reduction in articulation when only frequencies above 1,500 cycles are eliminated and are influenced the least when only frequencies below 1,500 cycles are reduced or eliminated. These were classified as high frequency speech sounds.

2. Those that show the greatest reduction in articulation when only frequencies below 1,500 cycles are eliminated and are influenced the least when only frequencies above 1,500 cycles are eliminated. These were classified as low frequency speech sounds.

From these vowels and consonants a list of real words of the consonant-vowel-consonant type was composed. It should be noted that *all three units* in each word were selected and combined to give frequency discrimination. The resulting test was organized into lists of high frequency words (HF) and low frequency words (LF). The two different lists are scored separately and the two ratings of articulation result. One set of words, which comprised the materials of the test as used in our present study, is shown in Fig. 1. This is an actual section

"right "left "air "bone "masked -- db	db	hf-1	lf-2	hf-3	lf-4	hf-5	lf-6
		peach	lair	space	hair	peace	lore
		teeth	bore	chat	more	fat	mum
		chase	hum	feet	bum	shape	roar
		pat	war	teach	mar	pitch	wall
		fifth	robe	safe	roam	cheap	mob
		seat	mare	feast	well	taste	rub
		fast	bell	chafe	hole	sat	moon
		chief	home	cease	rare	face	wear
		paste	rob	pass	bob	cheat	rum
		fist	ball	thief	hall	seep	hull
	C						
	V						
	S						

Fig. 1. Basic lists of high frequency words (hf) and low frequency words (lf) in Beasley's differential speech-hearing test as used in the present study.

from the score sheet as used during the testing, and the word lists are arranged in the order as they appear on the first half of the standardized recording. These first six lists of words are repeated on the second half of the record, but in shuffled order to reduce the tendency of memorizing. The whole recording presents altogether 12 lists of 10 words each.

The words are listed alternately high frequency and low frequency words as indicated at the top of each column. For convenience in scoring, the phonetic elements in each word are separated by a space. The technician conducting the test strikes out the unit or units in the word as they are missed, and can quickly score the column before passing to the next list. This is a definite advantage in clinical testing where time is a critical consideration. At the foot of each column are blank spaces for writing the consonant, vowel and word scores and percentages. In the present study, only consonant scores have been used as the basis for plotting articulation curves, the reason being that the consonant sounds give the most critical differentiation between high frequency and low frequency perception. Suitable spaces are blocked off on the form for indicating which ear was tested, whether by air or bone conduction, and the attenuator setting in decibels at the top of each column. The order in which different intensity levels are used may be varied at will, and likewise the lists that are played at particular levels may be varied at will. This is a definite advantage in clinical testing.

This form of speech-hearing test was subjected to considerable engineering standardization at the Acousticon Laboratory in order to obtain a high quality recording and a standardized method of control when the records are used with the speech-audiometer.

IV. METHOD OF CONDUCTING THE TESTS.

As a rule, each patient was given the pure tone audiometer test first, followed by the speech audiometer test. Frequently, a patient was given both tests at the same visit. If not, the second test followed in a few days.

In taking the speech audiometer test, the subject listens to the words through the earphones, one ear at a time, and pronounces the word as heard. The technician listens to the subject call off the words, and strikes out the unit or units of each word incorrectly called, or checks out the whole word as correct, if that is the case. There is sufficient time between each list of words for the technician to score each column and

write down the number of consonants, vowels and words called correctly. This is a definite aid in determining the manner of conducting the test on a particular patient.

A typical procedure in giving this test is to play the first two lists—one HF and one LF—at a sound pressure level of 80 db, then to work up or down in level, depending upon the response of the patient. The objective in each test is to determine the maximum level at which the patient obtains a zero score and at least two levels 10 db apart at which the maximum scores are obtained. Between these two end-points, measurements are made at 10 db intervals. When the level of scores drops abruptly in a particular 10 db step, another test is conducted at the 5 db interval. As the percentage scores approach zero, 5 db intervals are employed. For a typical clinical run, it is usually sufficient to employ only six different levels, if these are chosen judiciously to include the two end-points, which are essential. It is often necessary to repeat the levels used at the beginning, especially when subjects are taking the test for the first time, for usually some learning or adaptation to the observations is required.

V. RESULTS OF TESTS ON SPECIAL NORMAL GROUP.

In order to have a satisfactory normal reference against which the data collected on clinical patients could be compared, a series of tests was given to a selected group of normal subjects. These 50 normal subjects were drawn largely from existing files, and the group consisted entirely of persons with normal pure tone audiograms for both ears regardless of age and sex. There were no appreciable losses for any tones, even at the higher frequencies. Each subject was given an extended series of speech audiometer tests in addition to a complete pure tone audiometer test before and after the speech audiometer tests.

The series of speech audiometer tests extended over a period of six months. Each subject was tested on each ear five times. The tests were divided between three different days for each subject at intervals ranging from a few days to a month. In each test run for either ear, one HF and one LF list was

presented once at each of 12 sound pressure levels: from 80 to 50 in 10 db steps, and from 50 to 10 in 5 db steps. The composite articulation scores for all subjects, both ears, all tests were computed separately for high frequency and low frequency word tests.

The results from the tests on these 50 normal subjects are shown in Figs. 2 and 3. The chart in Fig. 1 shows the essen-

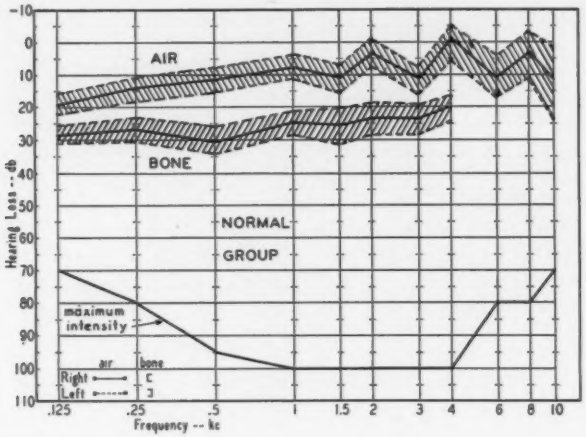

Fig. 2. Semi-interquartile range of pure tone audiometer tests by air and bone conduction for the 50 selected normal subjects. Solid lines in middle of each shaded area represent median values for each frequency distribution.

tial characteristics of the distributions of measurements obtained with the pure tone audiometer tests for both air and bone conduction tests. These are composite distributions for right and left ears (air conduction) and right and left mastoids (bone conduction). Masking was not used for the bone conduction tests on normal subjects. The shaded areas on the chart show the representative areas for normal hearing by air and bone conduction for these subjects under our testing conditions. It is apparent that the range of variance for bone conduction is no greater on these normal subjects than it is for air conduction tests. We propose to use these reference areas as a basis for further analysis of relationships between

results of speech audiometer tests and differential ratios between relative amounts of hearing loss for air and bone conduction.

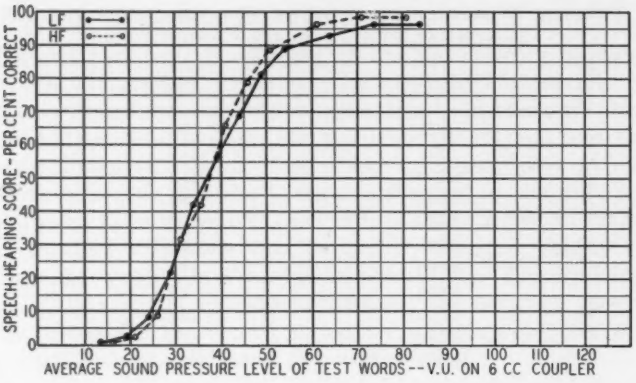

Fig. 3. Articulation curves for high frequency words (dashed curve) and low frequency words (solid curve) resulting from the prolonged series of tests given to 50 selected normal subjects.

The dashed lines bordering either shaded area on this chart indicate the limits of the semi-interquartile range, which includes the middle 50 per cent of the measurements at each audiofrequency. The heavy black line in the middle of each area indicates the median value (midpoint of frequency) for each distribution. We have used this median value for the normal group as the actual zero reference for normal hearing by air conduction in the charts shown in Figs. 4, 6, 8, 10 and 12. The irregularities of this median curve in Fig. 2 reflect largely the basic calibration characteristics of the pure tone audiometer used. By using the experimental "normal" curve as the zero reference, considerable smoothing of the curves in the charts referred to is accomplished, and facilitates interpretation of the relative differences beween groups in the ensuing analysis. For the sake of complete accuracy, the numerical values of the points on this normal median curve are given here. These values were subtracted from the experimental median values for the patient data before plotting on

the five charts referred to above. The original curves can be restored by anyone interested in doing so simply by adding these reference values to the points on the curves as plotted.

TABLE 1. NUMERICAL VALUES OF THE MEDIAN CURVE FOR 50 NORMAL SUBJECTS, AIR CONDUCTION.

Audiofrequency (Cycles)	Value Db on Chart
125	19.4
250	14.9
500	11.4
1,000	8.2
1,500	11.4
2,000	3.9
3,000	11.3
4,000	— 0.1
6,000	10.5
8,000	3.6
10,000	11.7

The articulation curves for LF and HF consonants resulting from the extended series of speech audiometer tests given to the 50 normal subjects are shown in Fig. 3. Each point on each curve represents the scoring of 10,000 consonants. There were 120,000 consonants scored for each curve, or a total of 240,000 experimental observations for the two curves. They represent the normal reference for the speech audiometer tests as conducted under our conditions as described. It is noted that the curves for HF and LF words are not significantly different for the normal subjects. A composite average between the two curves does not differ significantly from the normal articulation curves for PB word lists as reported by Davis[4] and Thurlow.[5] This suggests that equipment and techniques for standardizing speech hearing audiometers for general use are well within the realm of practicality. An unexpected finding is that even though the scoring is based entirely upon perception of consonants, the articulation curves are nearly equal for normal subjects. It should be pointed out in this connection that the *low frequency consonants* used in this test are on the average from 8 to 20 db higher in peak values

than the *high frequency consonants,* even though the V. U. sound pressure levels of the interposed *vowels* do not differ more than 2 db on the average for the HF and LF lists.*

VI. ANALYSIS OF DATA FOR CLINICAL PATIENTS.

The body of records collected on the 850 patients provides valuable information which may be analyzed in a variety of ways to reveal fundamental relationships between pure tone audiometric tests, by both air and bone conduction, and the speech audiometer tests. The present analysis aims at one specific objective, namely, to determine whether the differential speech audiometer test used in this study serves to reveal any useful information that cannot be obtained readily by using other currently available test materials. The organization of data in the subsequent analysis was designed specifically to test the theoretical assumptions from which the differential speech audiometer test originated.

The first step was to derive an index figure for the *degree* of pure tone hearing loss by air conduction for either ear of each patient. For this index, a simple average was computed for the hearing losses at 1,000, 1,500 and 2,000 cycles. This is designated as the middle range loss (MRL). This average was computed for each individual pure tone audiogram, either ear, and written on the patient's statistical chart.

The second step was to compute a weighted average for the frequencies above 2,000 cycles. The weights assigned were: 3,000 cycles, one-third; 4,000 cycles, one-third; and the average loss for 6,000, 8,000 and 10,000 cycles, one-third. This weighted average is referred to as the high frequency loss (HFL). This average likewise was computed and written on each patient's statistical chart.

A code was entered for either ear on each chart next in accordance with the following groupings:

Group 1: MRL, 15 db or less.

Group 2: MRL, 16 to 30 db.

*The S. P. L. values for the **consonants** were determined from continuous film records of cathode ray oscilloscope projections of the speech patterns.

Group 3: MRL, 31 to 45 db.

Group 4: MRL, 46 to 60 db.

Group 5: MRL, 61 to 80 db.

Group 6: MRL, 81 db and over.

A code was entered then on each chart for either ear to specify one of three relationships between the relative values of MRL and HFL, as follows:

Subgroup A: HFL equal to or less than MRL.

Subgroup B: HFL from 1 to 10 db greater than MRL.

Subgroup C: HFL is 11 db or more greater than MRL.

The frequency distributions were then compiled for all of the original pure tone audiometer tests for all individual ears classified according to the above groups. While sorting the data sheets, we noted that there were only a few instances in which ears classified as 5C and all of Group 6 attained any perception at all on the speech audiometer test. Consequently, these groups were excluded as not serving any purpose in the present analysis. Statistical constants were computed for the frequency distributions of audiometric measurements for each grouping. Study of these numerous tables indicated that the trends could be represented suitably by the median curves of the hearing loss data for each subgroup and depict the relationships existing. These median curves are plotted in the charts of Figs. 4, 6, 8, 10 and 12.

Similarly, the articulation curves for LF and HF consonants were computed for each of the subgroups. These are plotted in the charts of Figs. 5, 7, 9, 11 and 13.

Each subgrouping yielded a sufficient sample to be useful. The number of ears which became classified according to the preceding definitions are given in Table 2.

A careful and detailed examination of the pure tone audiometric and speech audiometer charts, making comparisons between each associated pair, then successive comparisons between the charts for different groups, will enable the interested reader to derive a number of meaningful observations.

TABLE 2. DISTRIBUTION OF EARS ACCORDING TO CLASSIFICATIONS DEFINED IN THE TEXT.

Major Group	Subgroup A	Subgroup B	Subgroup C	Totals
1	264	264	61	589
2	75	106	77	258
3	70	80	60	210
4	69	66	34	169
5	54	39	—*	93
Totals	432	555	232	1,319

*Excluded.

We shall call attention to only the major observations that are of particular interest in relation to the differentiations revealed by differences between the articulation curves for LF and HF words and the relationship beween these differences and the character of the median audiograms for the correponding subgroups.

As the first example, consider the charts for Group 1 in Figs. 4 and 5. The most indicative observations to note for this paired comparison are that the median audiogram curves for Groups 1A, 1B and 1C for the range from 125 to 1,500 cycles are quite uniformly horizontal lines and fall within a range of 5 db; whereas, in the range above 1,500 cycles, the 1A is continuous with that portion for the LF range, the 1B curve shows a drop of 15 db in the HF range, and the 1C curve shows a sloping drop in the HF range averaging about 30 db. On the corresponding speech-hearing articulation curves for this group, as illustrated in Fig. 5, the LF articulation curves (solid lines) are close together, have very nearly the same curvature, and are close to the normal curve reference. In contrast, only the 1A articulation curve for HF words (dashed line) remains closely associated with its LF mate on the graph; the 1B HF curve departs moderately from its LF mate, but the 1C HF curve departs conspicuously from its LF mate. These relative differences between each pair of articulation curves follow almost exactly the characteristic differences between the median audiograms of Group 1.

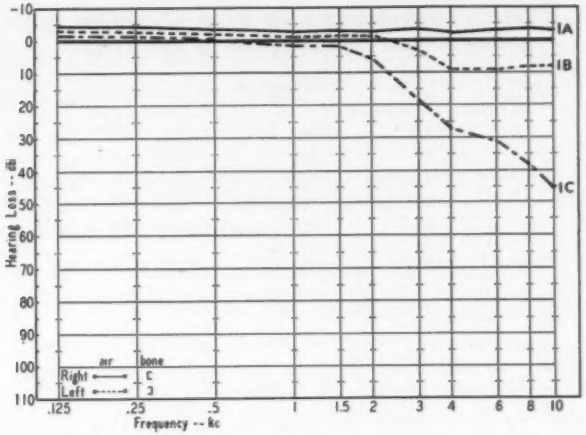

Fig. 4. Median air conduction audiograms for Groups 1A, 1B and 1C. The zero reference line in this figure, as well as in Figs. 6, 8, 10 and 12, is based upon the median values for the selected normal groups, air conduction, Fig. 2.

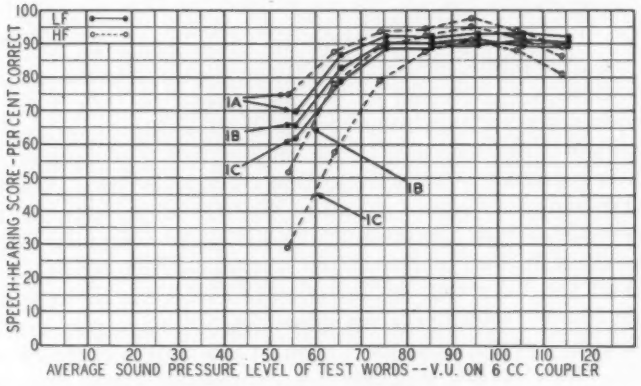

Fig. 5. Articulation curves resulting from differential speech-hearing tests given to Groups 1A, 1B and 1C. Compare with Fig. 4.

Similarly, examine the pair of charts for Group 2 in Figs. 6 and 7. Here again the portion of the median audiograms for the range from 125 to 1,500 cycles are close together for

Subgroups 2A, 2B and 2C, whereas the differences between the portion for the HF range are separated more conspicuously. Note that the order of the LF and HF portions of the median audiograms are reversed, even though slightly; that is, the 2C LF portion shows the least amount of hearing loss,

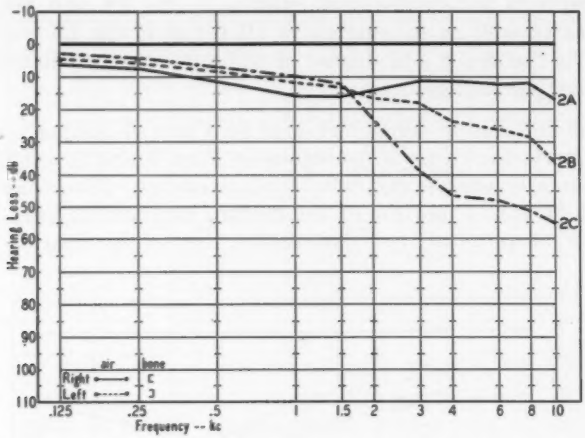

Fig. 6. Median air conduction audiograms for Groups 2A, 2B and 2C. Compare with Fig. 7.

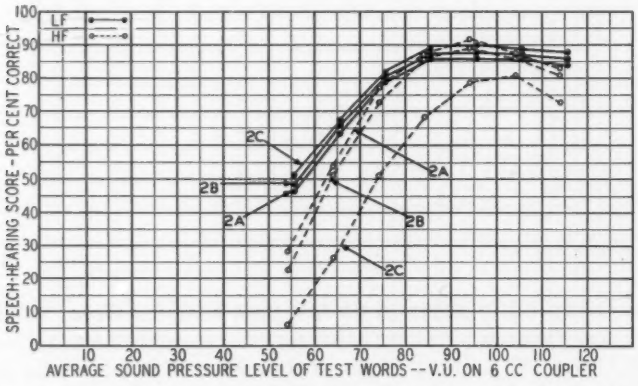

Fig. 7. Articulation curves resulting from differential speech-hearing tests given to Groups 2A, 2B and 2C. Compare with Fig. 6.

whereas the 2C HF portion shows relatively the greatest amount of hearing loss. On the HF and LF articulation curves for these groups, as shown in Fig. 7, the LF curves are close together and show less impairment for LF words than the HF curves show for HF words. The latter curves deviate from the LF curves conspicuously. In particular, the 2C curve is widely displaced relative to the 2A and 2B HF curves as well as in relation to all three of the LF curves. This is the order and degree of differentiation exhibited by the median audiograms.

The differential trends revealed by a paired comparison of the charts for Group 3, as shown in Figs. 8 and 9, exhibit a particularly unique reversal of relationships. Note that the order of the LF portion of the median audiograms (see Fig. 8) are conspicuously reversed, that is, the average hearing loss

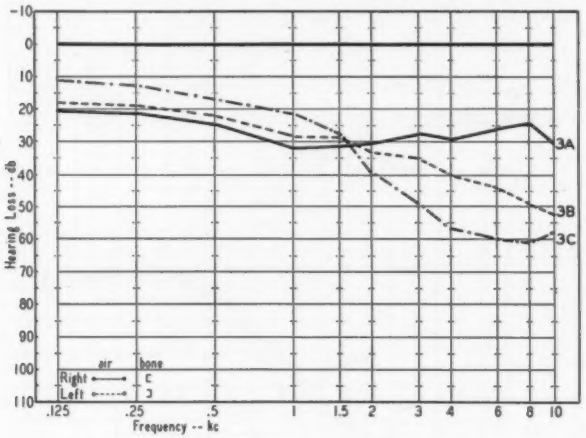

Fig. 8. Median air conduction audiograms for Groups 3A, 3B and 3C. Compare with Fig. 9.

for Group 3C is about 15 db *less* than that for Group 3A in the low frequency range; whereas, the average hearing loss for Group 3C is about 30 db *greater* than that for Group 3A in the high frequency range. The order of the articulation

curves for LF and HF words is reversed as shown in Fig. 9, corresponding to the reversal shown by the median audiograms; moreover, the displacements of the articulation curves correspond proportionately to the relative differences in degrees of hearing loss revealed by the median audiogram curves.

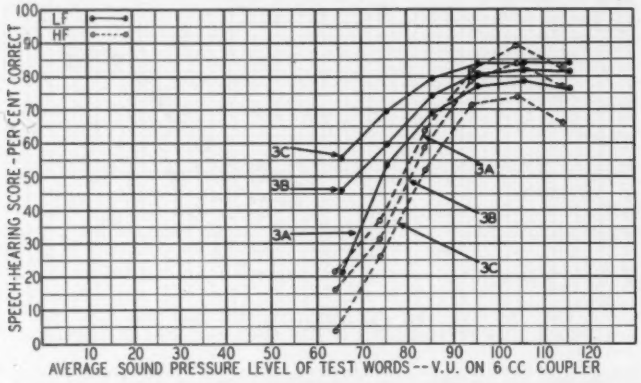

Fig. 9. Articulation curves resulting from differential speech-hearing tests given to Groups 3A, 3B and 3C. Compare with Fig. 8.

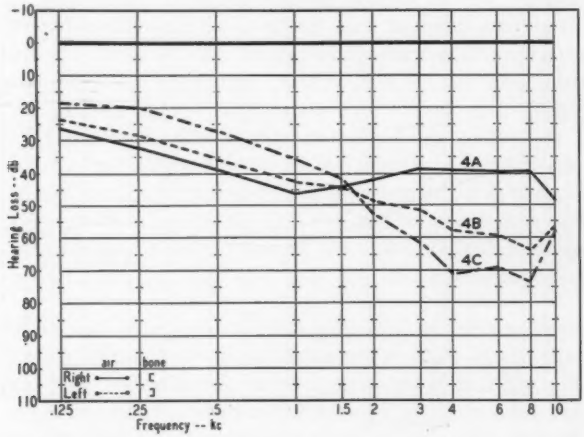

Fig. 10. Median air conduction audiograms for Groups 4A, 4B and 4C. Compare with Fig. 11.

Similar reversals and character of trends as described for Groups 3 and 4 are exhibited for Group 4, Figs. 10 and 11, and for the two subgroups of Group 5, as shown in Figs. 12 and 13.

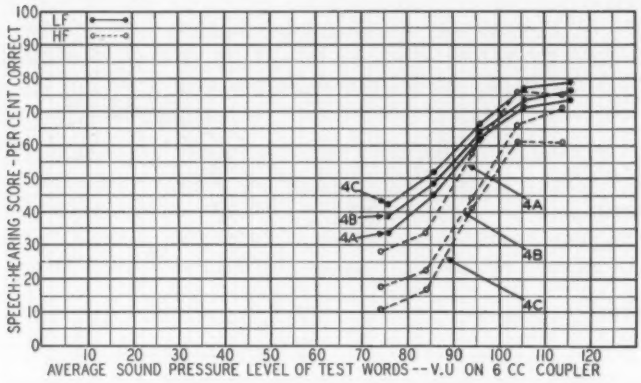

Fig. 11. Articulation curves resulting from differential speech-hearing tests given to Groups 4A, 4B and 4C. Compare with Fig. 10.

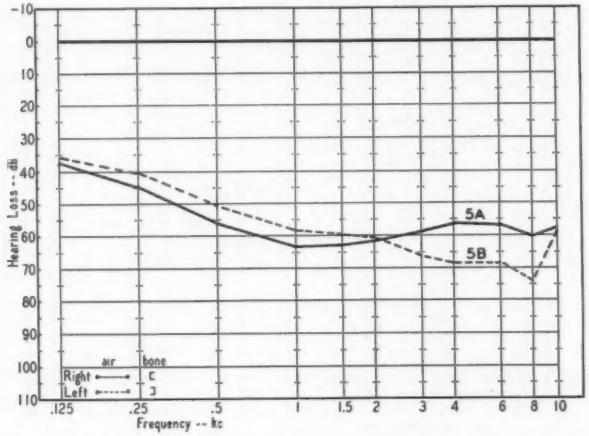

Fig. 12. Median air conduction audiograms for Groups 5A and 5B. Compare with Fig. 13.

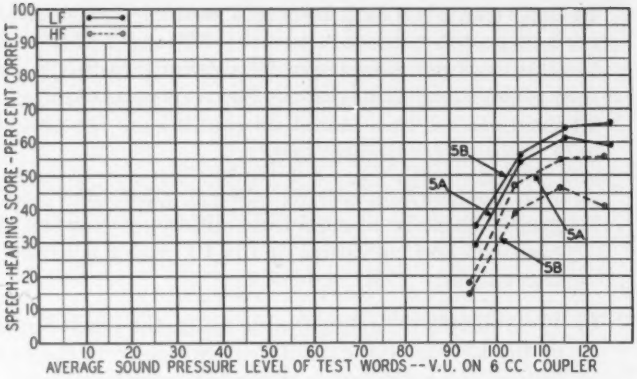

Fig. 13. Articulation curves resulting from differential speech-hearing tests given to Groups 5A and 5B. Compare with Fig. 12.

VII. SUMMARY.

1. A new kind of speech-hearing test, known as the Beasley Differential Speech-Hearing Test, is described. This test is composed of monosyllabic words of the consonant-vowel-consonant type, which are divided into two lists on the basis of the energy-frequency characteristics of the phonetic elements. The words in the two lists are designated as low frequency (LF) and high frequency (HF) words. The initial and final consonants in these words contribute more than the vowels to the differentiating efficiency of the test and, hence, scoring is based upon perception of consonants. The test is organized and administered in such manner that two articulation curves result: one for LF and one for HF phonetic elements.

2. This test was given to 850 patients, of whom about 500 had hearing impairments ranging from slight to very severe. In addition, pure tone audiograms by air and bone conduction were obtained routinely on each patient. A prolonged series of tests were given to 50 normal subjects as a control for comparison with the patients' data.

3. In this report, the data were analyzed by a group trend method to determine whether the HF and LF articulation curves bear any consistent relationship to the pattern of pure tone audiograms. The results, as depicted in 12 charts based upon statistical calculations for grouped data, indicate consisently that:

   A. For the subjects having normal pure tone audiograms, there is no significant difference between the positions and curvature of the LF and HF articulation curves.

   B. For subjects with impaired hearing, the displacement of the LF and HF articulation curves from the position of the articulation curve for normal subjects is approximately proportional (but not equal) to the average amount of hearing loss for pure tones at 1,000, 1,500 and 2,000 cycles.

   C. For subjects with different *patterns* of pure tone audiograms, the LF and HF articulation curves are displaced relative to each other in amounts and direction that are proportional to the relative average hearing loss for pure tones below 1,500 cycles (LF) and above this reference (HF).

4. Although these trends, which are based upon grouped data, are consistent throughout, there is a significant number of cases (approximately 28 per cent) in our records that do not conform. Prediction of speech-hearing ability from the pattern of pure-tone audiograms is not valid for individual cases. The authors expect to explore the reasons for these exceptions to the basic group trends in a subsequent analysis.

5. The demonstrated efficiency of this particular speech-hearing test in revealing differences between the abilities to perceive low frequency and high frequency phonetic elements of speech-sounds has a practical significance for the otologist, especially in evaluating end-results after the fenestration operation for clinical otosclerosis.

6. Similarly, this differential speech-hearing test has a direct application to the selection of hearing aids in individual cases, and appraising the *nature* of hearing improvement accomplished by different hearing aid fittings.

ACKNOWLEDGMENT.

The authors acknowledge with appreciation the cooperation of the Engineering Department of the Acousticon Laboratory in providing equipment and technical services in support of this study.

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THE RECRUITMENT OF LOUDNESS PHENOMENON.*†

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The "recruitment phenomenon," after twenty-odd years, although universally accepted, is still not clear to many otologists; they do not understand the loudness function of the ear. It is for these reasons and also to keep you informed of the newer tests and uses of "recruitment" that this brief paper has been written.

To orient ourselves let us consider just what is meant by "recruitment." When a sound (a pure tone, a band of frequencies, a noise, speech, or any sound) is gradually increased in intensity above the threshold of a normal hearing ear, or an ear blocked by a purely impedance lesion, it will be sensed with an orderly logarithmic increase in its loudness. In other words, the loudness function in such ears has a fixed value. It varies somewhat with frequency.

If one ear has normal hearing and the opposite ear an impedance deafness, the threshold of the deafened ear will be a definite number of decibels higher than the normal threshold. If the sound is increased 10, 20, 30 or any number of decibels over threshold in each ear the difference in decibels at threshold will be maintained at the higher intensity levels. The deafened ear will at all intensities of sound hear the sound the same number of decibels fainter than the normal ear, as indicated by the threshold determinations and will require the addition of its threshold loss in decibels to bring it up to the same sensation of loudness as the opposite better ear.

*Read at the Fifty-fourth Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc., San Francisco, Calif., May 25, 1950.

†This paper in part is a condensed version of a paper read before The International Congress of Otolaryngology in London, July 19, 1949.

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On the other hand, if one ear has normal hearing, and the opposite ear is deafened by a neural or so-called "nerve deafness," the difference between the two ears at threshold will disappear as the sound is increased over threshold, until at high intensities the sound appears just as loud (and sometimes even louder) to the deafened ear as it does to the normal ear. This pathological or pathophysiological increase in the increment of loudness is called "recruitment of loudness," and for short, "recruitment." It is pathognomic of auditory neural lesions.

Once recruitment is understood it is apparent that it may be demonstrated in many ways. I shall describe six techniques which are usable as tests for its presence.

Using a single receiver monaurally transferred from ear to ear, or preferably twin receivers, switch the sound from the audiometer alternately into the right and left ears. By trial and error balance the loudness of the testing frequency binaurally. This method of procedure is called the "alternate binaural loudness balance" technique.

The recruitment phenomenon was discovered and measured by this method some 25 years ago. I first reported it in 1928. It may be most dramatically demonstrated in monaural pure neural deafness when the hearing in the opposite ear is normal. We commonly use the term "nerve deafness" as synonymous with a deafness caused by lesions anywhere in the neural mechanism of hearing. It is more accurate to use the term "neural deafness" and qualify it as "peripheral, central and cortical" when we wish to differentiate lesions in the different levels of the auditory neural pathways.

Fig. 1 shows the audiograms of the right and left ears of a patient with monaural pure neural deafness at 2,000 c.p.s. and above. The left ear shows a loss of 60 db and the right ear no loss. Now, although at 2,000 there is a difference of 60 db in the thresholds of the right and left ears, a very loud sound (in this instance 90 db above normal threshold) appeared to the patient to be equally loud in the normal and the severely

deafened ear. In other words, the number of decibels required to binaurally balance the sound was the same.

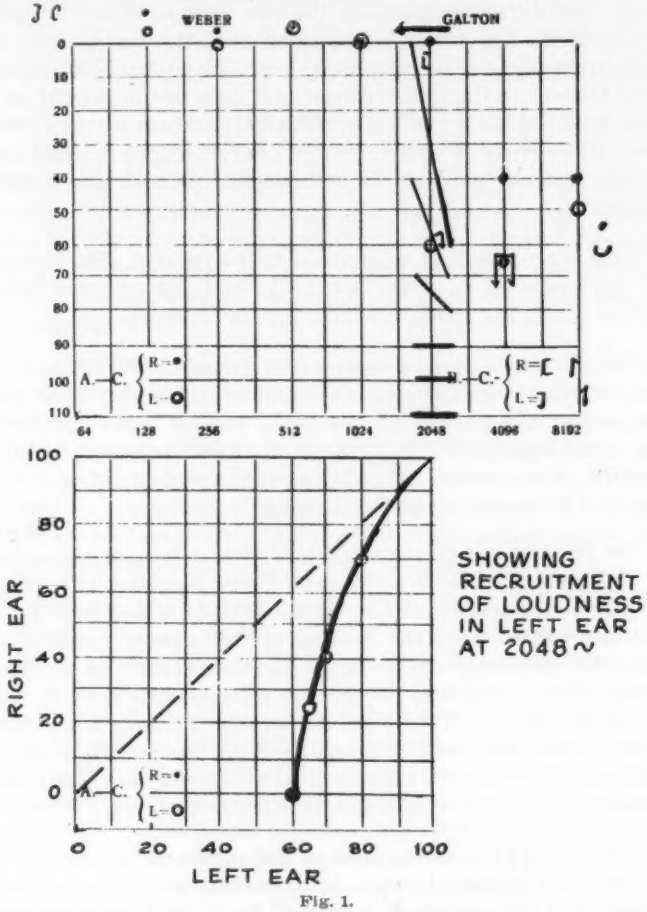


Fig. 1.

In the standard audiogram chart the pathological threshold (the decibel loss) is plotted below the average normal threshold line. It is upside down insofar as above and below threshold is concerned.

If we plot loudness in the right ear to the left of the frequency ordinate, and the loudness necessary to balance it in the left ear to the right of the ordinate, a line drawn between these points will show by its length, its slope and the decibel intensity indicated at each of its ends, the intensities necessary for equal loudness in the two ears. A series of lines joining all the equal loudness plottings will produce graphically what may be called a pole ladder, or a phantom ladder graph (a ladder with rungs but without sides).

The equal loudness balance line joining the thresholds in this graph shows that there is here a difference in the intensities of 60 db at 2,000 c.p.s. Increase the intensity of the sound in the deafened ear to 10 db above its threshold—bringing it to 70 db above normal threshold—now apply the same sound to the right ear, and by trial and error adjust it until it equals in loudness the 70 db sound as heard in the left ear. As illustrated in the audiogram, the right and left ears balance in loudness at 40 db and 70 db, respectively. The intensities necessary to obtain this balance show a difference of 30 db, whereas at threshold there is a difference of 60 db. There has been an increase in the sensation of loudness (an increment over what might have been expected) of 30 db in the left ear. Now increase the intensity in the left ear another 10 db, making a total of 80 db above normal threshold. The right ear now requires 70 db over its threshold to balance this 80 db sound in the left ear. The ears are now only 10 db apart in their equal loudness plottings. (The left ear has now recruited 50 db of loudness.) Increase the left ear to 90 db and the intensity necessary for equal balance in the right ear is now also 90 db. In some way the left ear has recruited an added increment of loudness sufficient to completely overcome the difference of 60 db shown at threshold.

The phenomenon is shown plotted in another way in the graph below the chart. The intensities heard by the better (right) ear are measured along the ordinate and those used to balance them in the poorer (left) ear along the horizontal base line (the abscissa). In this instance only the 2,000 frequency is illustrated. The 45 degree line represents the equal

loudness balance plottings of two ears with normal loudness function. The curved line joining the equal loudness plottings of the normal right and deafened left ears shows the amount, degree and changing increment of the recruitment of loudness in the left ear.

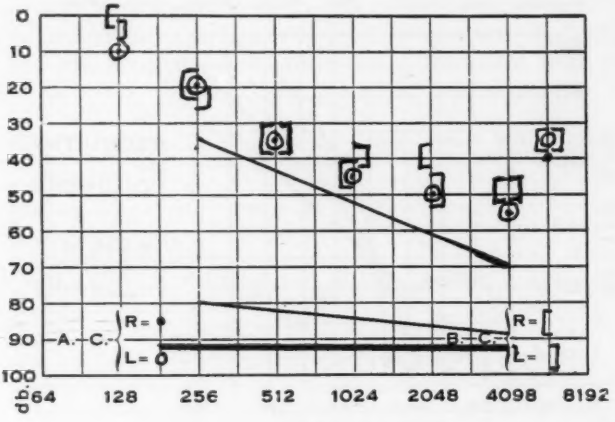
Recruitment occurs only in the very limited or wide frequency bands affected by neural deafness of any degree, and at any and all frequencies. It was never found in an ear with pure obstructive (impedance) deafness, or with the shadow curve of monaural total deafness. In bilaterally equal neural deafness, because under such circumstances both ears recruit equally, recruitment is present although not apparent when using the equal binaural loudness balance test; however, it is present in such cases in both ears and may be detected by other techniques.

Notice that the greatest recruitment occurs just over threshold and that its increment gradually diminishes with increasing intensities of the testing sound.

The initial increase of recruitment is often startling. For instance, it may require a sound 25 or more decibels over threshold in a near normal ear to equal in loudness one 5 db over the threshold in a severely neurally deafened ear. It is this observation which supplies us with a simple test for detecting the recruitment in instances where both ears have similar losses of heaing or in which there is only one ear to test, the other being totally deaf. To detect this initial (just above threshold) over increment in loudness, use a 1 to 2 db increase over the threshold intensity. Even $2\frac{1}{2}$ db is usually satisfactory for routine clinical use. If the patient is easily and quickly cognizant of a 1, 2 or $2\frac{1}{2}$ db increase in intensity over threshold it indicates the presence of the recruitment phenomenon. In a normal ear or an ear with impedance lesions, not only is the threshold indefinite but an increase of 2 db over threshold is not noticed, or is detected with difficulty, particularly by untrained observers.

The reason why the threshold and a slight increase over threshold are so definite in neural deafness is because of

"recruitment." The sound, or increase, appears suddenly, and, therefore, there is no doubt as to whether it is or is not heard, or as to whether the increase is or is not heard. At a fraction of a decibel below threshold it is not heard; at a fraction decibel increase it is heard, and a 1 or 2 db increase may sound like a 5 or 10 db increase. The threshold becomes more and more indefinite the greater the coincidental obstructive lesions. The reason is that the greater the impedance lesion the less proportionally is the neural deafness, and the less the neural deafness the less the initial recruitment. If recruitment ceases at any level below saturation intensities it indicates that there is a coincidental impedance deafness.



UNILATERAL AND BILATERAL
BIFREQUENCY BALANCE BY A.C.

Fig. 2.

If the threshold curves of either one or both of two ears are not horizontal, you may balance a high tone, say 2,000 or 4,000 against a lower tone, say 500 or 250, in one or the other nonhorizontal loss ears. Fig. 2 shows how both single frequencies and several different frequencies may be balanced in loudness by this technique.

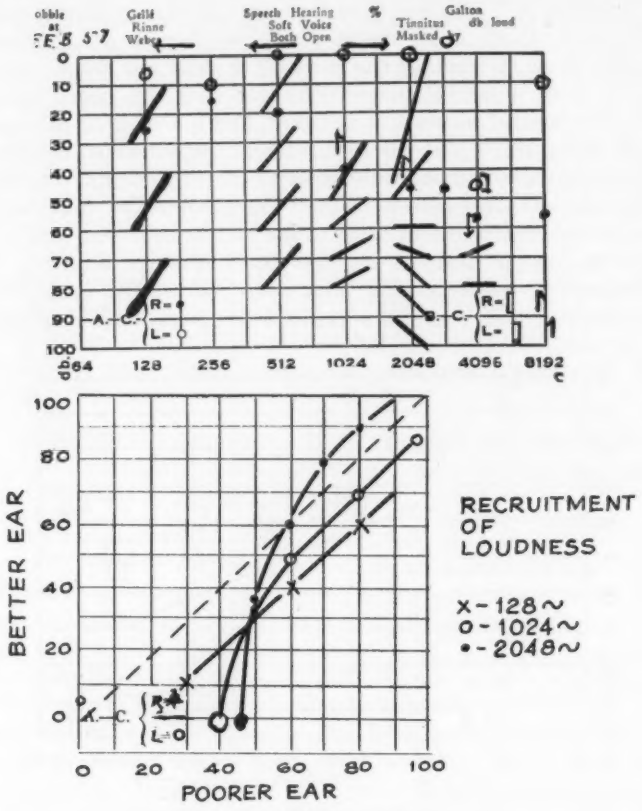


Fig. 3.

Fig. 3 shows the audiogram of a patient with a mixed type of deafness, an impedance deafness in the right ear at the lower frequencies and a neural deafness at the middle and higher frequencies. The recruitment phenomenon is absent in the former and marked in the latter. Notice that there is no recruitment for 128, a slight indication of recruitment for 512, a moderate degree for 1,024, and a marked degree of recruitment for 2,048; also, that at 2,048 there is more than a complete recruitment; there is an over-recruitment. The deaf ear

at this frequency senses very loud sounds even louder than the normal ear; also, below the audiogram the equal loudness balances are plotted for three frequencies.

When losses are binaurally equal at the different frequencies, and the audiograms of the two ears are horizontal; only one of the techniques I have just described is available; however, there are several other ways of overcoming the difficulty.

Dr. Georg v. Bekesy[1] has constructed an audiometer to automatically record the recruitment phenomenon. This audiometer presents the tone in constantly increasing steps of 2 db each until the patient indicates he hears it by pressing a button. This pressing of the button causes the intensity to stop rising and immediately to diminish constantly until the patient indicates he no longer hears it by releasing the button. In this way a tracing is obtained which fluctuates from just below to a few decibels over threshold (see Fig. 4). The

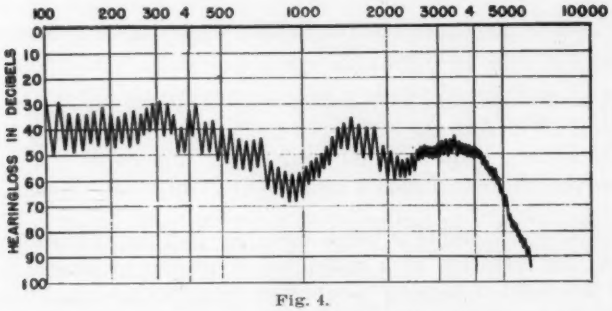


Fig. 4.

graphs show wide swings in the tracings (the differential limens for intensity) about threshold in conduction deafness, and very short swings in neural deafness. The extent of the swings also will be influenced by the response time of the patient.

Another technique utilizes the fact that the minimum perceptible change (difference limen) in intensity is larger in normal ears or in impeded ears than in ears with neural deafness and, as I have pointed out, becomes progressively smaller

with increasing intensity above the pathological threshold. Lüscher and Zwislocki[2] measure the difference limen by using a tone preferably 40 db over threshold and modulating its amplitude, *i.e.*, without interrupting the tone varying the loudness every half second (two fluctuations per second) and gradually lessening the variations in intensity until no change is longer perceptible, until the tone appears continuous and of even timbre. The patient indicates the steadiness or fluctuations in the tone by holding his hand steady or by raising and lowering it as the case may be. The 40 db over threshold is used because loud sounds show less variation with frequency than sounds near threshold, and the amount of recruitment increases even though the ratio declines.

The findings (difference limen) may be expressed either in percentages or decibels and plotted by drawing thick black vertical lines just below the thresholds and superimposed upon the frequency ordinate lines.

Practice enables patients to become more expert and lessens their difference limens.

A neural deafness is presumed when in a case showing more than a 30 db loss the difference limen falls below 8 per cent. Only a very acute normal hearing or impedance deafened observer can detect such a small figure (difference limen).

Another technique is based upon the fact that immediately after the cessation of a sufficiently loud and prolonged tone the threshold of hearing is definitely raised by so-called "auditory fatigue." The threshold shift is greater the closer the testing sound corresponds in frequency with the "fatiguing sound," and the greater the fatigue neural deafness. Huizing[3] showed that immediately following a three-minute stimulation (by 2,000 c.p.s.) at 30 db over the pathological threshold, a threshold shift as much as 12 db may be considered as normal. A threshold shift of over 12 db may be considered as showing the presence of "recruitment" (in neural deafness the shift may be and usually is 19 to 40 db). To be on the safe side and for convenience I use 12½ db.

Since most audiometers have 5 db steps, a 15 db shift may be utilized as the dividing line between normal hearing or impedance deafness and neural deafness. In normal ears or pure impedance deafness there is no increase in loudness values of the testing tone and, therefore, no recruitment, no abnormal fatigue, and no abnormal shift in the threshold. The much greater loudness value obtained in the presence of recruitment explains the greater auditory fatigue produced in neural deafness. Huizing's test technique is simple and gives reliable results. Intensities more than 30 db over pathological threshold should be used with caution because of their large fatigue and possible acoustic trauma effect.

Huizing points out that when, as sometimes occurs, recruitment is absent in the presence of lowered bone conduction, the threshold shift occasioned by masking sounds is within normal limits (not over 12 db). These observations substantiate my own contention that the bone conduction loss under such circumstances should not be interpreted as indicative of a neural deafness; on the contrary, it indicates an inner ear or labyrinth window impedance deafness. In such instances the fenestration operation is not necessarily contraindicated, even though there is a bone conduction loss. It should be clear that it is not the loss in bone conduction which is unreliable in these cases; it is the failure to interpret it properly.

As a rough illustration of a "recruitment" due to loss in capacity, envision two tubes similar in length but differing in capacity (in the ratio of one to three), one 33-1/3 cc., the other 100 cc., the smaller cone shaped; the larger, a cylinder (see Fig. 5).

Quickly fill each tube to 25 per cent of its capacity. Mark this 25 per cent level on vertical lines as indicated in the diagram. Now fill both to 50 per cent of capacity and again mark the levels on the vertical lines. Then fill both to 75 per cent of capacity and mark the levels. Finally fill both to 100 per cent of capacity. Draw straight lines between the similar levels of per cent capacity of each tube. As these lines join the higher and higher equal per cent of capacity levels they

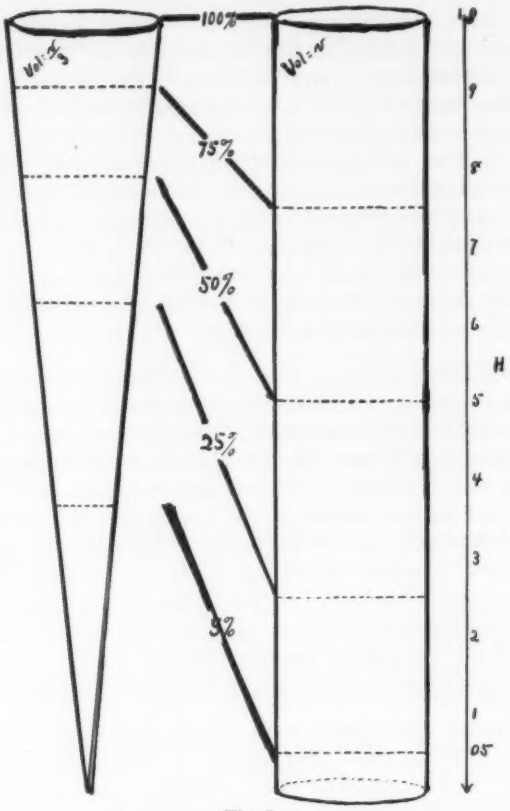


Fig. 5.

make smaller and smaller angles with the horizontal and become shorter and shorter until at 100 per cent the line is the shortest and is horizontal. In other words, with similar percentages of capacity fillings the fluid in the smaller tube, starting with a marked difference in the level, gradually but with decreasing increments approaches and finally reaches the same level as the fluid in the larger tube.

If the neural mechanism senses degrees of loudness in proportion to the per cent of capacity to which it is saturated

with sound, and not only in relation to the amount of sound with which we fill it, then the higher the per cent of filling with sound the higher the sensation of fullness. At 100 per cent capacity the sensation of fullness is complete and in the ear this appears to hold true even with marked loss of neural elements, the ultimate number of functioning elements constituting the capacity.

This explanation is helpful but is crude and unsatisfactory from several standpoints, and it does not lend itself to an explanation of over-recruitment of loudness.

Recruitment is demonstrable in the presence of masking and submasking environmental sounds. Such sounds in a way produce or simulate a neural deafness.

Both "vibratory" and "nonvibratory"[5] tinnitus will evoke recruitment for testing sounds of similar frequency. Not only the illusion of noise called tinnitus, but lesions causing the tinnitus produce neural lesions and, therefore, cause recruitment. Even subaudible tinnitus and subaudible environmental sounds may cause recruitment. Subaudible intensities by summation are superimposed upon similar or other frequencies. In this way a false threshold may be obtained. Also, the boosting effects of contralateral sounds suggest the presence of such phenomena. Recruitment is a sensation and is not necessarily exactly the same in different individuals.

As Huizing and others have pointed out, an indication that recruitment is present occurs when patients with neural deafness first try a hearing aid. There is then great difficulty in modulating the voice because of the short distance between the user's transmitter and his mouth. The recruitment not only causes a distortion of speech but also a discrepancy between the loudness of the voice of the hearing aid user and that of speakers some distance away. This may temporarily cause an emotional block so that he is unable to speak.

Recruitment is apparently sometimes absent in old people with neural deafness, but this should not be unexpected because tactile sensations in the aged are well known to be less well differentiated, and hearing is in essence a tactile sensa-

tion; moreover, attention may be less concentrated and the technique of the examiner may be at fault. It is often stated that bone conduction is lowered or absent in old people irrespective of the air conduction threshold. This in my experience is not true. One should be careful to inquire as to techniques used and as to the proper interpretation of the bone conduction loss.

Recently, Dix, Hallpike and Hood[4] reported the absence of recruitment in acoustic nerve tumors and explained this on the basis that in such cases there is no cochlear degeneration. They contend that recruitment arises only in lesions of the end-organ and, therefore, its absence in neural deafness provides a test for the differential diagnosis. This is a most interesting observation, and I wish it could be true. I have not as yet observed it, unless there was insufficient hearing to permit the test; however, my material is small. Fig. 6 shows

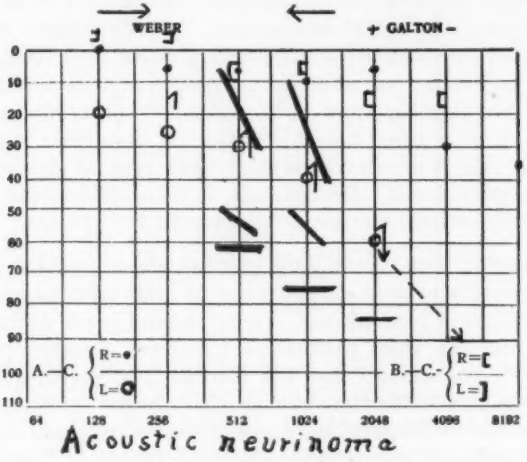


Fig. 6.

the audiogram of a patient recently tested at my request by Dr. Franz Altmann in the Neurological Institute, Columbia University, before excision of a neurofibroma of the VIIIth nerve. You will note that recruitment is clearly shown.

Again it should be pointed out that no recruitment occurs in a totally deafened ear, and no recruitment by the binaural loudness technique is apparent if both ears have similar neural lesions; also, that it is at times difficult and even impossible to mask the better ear without contralateral effects, and, moreover, crossed audition may affect the recruitment phenomenon obtained in the ear under test. A neurally deafened ear is hypersensitive to crossed masking because of the recruitment phenomenon which is inherent in it. For these reasons it is usually advisable to avoid masking when testing for "recruitment," and to use it carefully in determining thresholds. It is also pertinent to note that masking sounds may provoke in the contralateral ear a positive Rinne by masking the bone conduction more than the air conduction. It is possible that this may have happened in the case cited by Dix, Hallpike and Hood.

SUMMARY AND CONCLUSIONS.

1. Several techniques of testing for recruitment are described.

2. Recruitment is pathognomonic of neural deafness, but its absence does not necessarily preclude nerve deafness; block lesions may prevent recruitment.

3. Recruitment is greatest immediately above threshold and gradually diminishes in increment as loudness increases. It may appear to be less marked in the lower frequencies than in the higher because neural deafness is usually less marked in the lower frequency areas. As a matter of fact, the lower the frequency the greater the normal increment of loudness.

4. Recruitment may persist even after equal binaural loudness volumes have been reached, so that sounds 110 to 120 db loud may appear to be sensed even louder in the deafened ear than in the normal ear.

5. Recruitment is limited by impedance lesions and, therefore, the two ears, in spite of a recruitment of loudness

because of neural lesions, will always differ in their loudness balance levels by the exact number of decibels which is the measure of their difference in impedance. In this way it is possible to diagnose and measure the amount of the impedance lesions and the neural lesion with a single test.

6. Recruitment for speech is indicated when in moderately deafened ears (overall losses of 20 to 35 db) a 5 or 10 db increase over threshold in the loudness of speech will produce a marked increase in the loudness and intelligibility of the speech (a comfortable level), and more than a 20 db increase will cause distortion and confuse the patient. In obstructive deafness at similar levels a 20 db increase will not do this. Recruitment limits the usable intensity range in hearing aids both because of the speech intelligibility distortion and the fatigue and traumatic factors involved.

7. When recruitment is absent in the presence of markedly diminished bone conduction it indicates that this loss in bone contraction is not due to neural lesions, but is, on the contrary, due to impedance lesions, probably in the oval or round window regions.

8. Recruitment of sensation may be demonstrated in all sensory neural mechanisms.

9. Recruitment tests are valuable for the diagnosis of monaural, very severe or total deafness. (There is no recruitment in a totally deaf ear.)

10. Fatigue, inattention and environmental noise may affect the recruitment tests. Fatigue and noise produce and accentuate recruitment; inattention interferes with the tests for recruitment.

11. Recruitment is valuable as a test for malingering. The malingerer cannot accurately simulate it. If it is present he is not malingering insofar as his neural deafness is concerned.

12. When, as in some instances in otosclerosis bone conduction is lowered the recruitment tests are invaluable to differentiate impedance from neural lesions.

The tests for "recruitment" are reliable and should be employed regularly and with confidence.

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RADIATION THERAPY OF CANCER OF THE LARYNX.*†

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The treatment of carcinoma of the larynx is a subject of only the last 75 years of medical history. The first successful attempt to eradicate this lesion by surgical means marks an important milestone in the development of laryngology; however, the initial enthusiasm for successful laryngectomy and laryngofissure was followed by a period in which experience accumulated which led to the realization that surgical eradication of cancer of the throat is a procedure applicable to a limited group of cases. With the advent of radiology around the turn of the century, a new tool was at hand with which to attempt to combat this disease. As early as 1902, attempts were made to treat cancer of the larynx with Roentgen and radium rays. In a survey article, Gradenigo, in 1908, pointed out that radiation does not provide a satisfactory means of treatment, because the technical equipment is inadequate for use in the treatment of cancer of the larynx. It was not until 1922 that the first successful eradication of cancer of the larynx by radiological means was accomplished. Regaud, Coutard and Houtand at this time reported successful treatment of six advanced inoperable carcinomas of the larynx with Roentgen rays. This work not only established radiation therapy of cancer of the larynx but constituted the cornerstone of radiation therapy as a medical specialty. It was Regaud's experimental work carried out in 1914 which was the basis of the method employed in the treatment of these six patients. Inserting radium needles into rams' testes, he demonstrated

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that doses of low intensity applied over prolonged periods resulted in a more complete destruction of cells in active mitosis than is possible with high intensity, short term irradiation. He also found that low intensity irradiation carried out over a prolonged period of time results in a better protection of the adjacent tissues than is possible when high intensity short term irradiation is employed. This principle, which was first applied to the use of X-rays by Coutard and which is generally and correctly known as the "Coutard method," is based on treating the cancerous lesion over a period of several weeks, by exposing the lesion to Roentgen rays daily to fractions of the total dose over several hours. He contended that by fractionation and protraction of the radiation dose, it is possible to deliver a much higher total quantity of radiation than is possible with single dose, high intensity irradiation. Coutard's original method of treating carcinoma of the larynx consisted of giving 100 to 150 r. in a period of two to four hours daily over three to four weeks' time. He used 140 to 160 kv. generated X-rays and filtration varying from 10 mm. to 15 mm. aluminum. By this means he was able to provide highly penetrating radiation which in Coutard's experience produced less effect on the skin than any radiation quality theretofore used in radiological treatment. In considering Coutard's original method in retrospect, it is obvious that the great merit of Coutard's achievement lies in his recognition of the significance of fractionation of the radiation dose and heavy filtration of the X-ray beam. Protraction was an unavoidable necessity with the technical equipment at Coutard's disposal, and it has subsequently been shown to be of secondary importance; however, be that as it may, despite various modifications of the technique originally suggested by Coutard, the fundamental idea of delivering a carcinocidal dose of 5,000 to 7,000 r. in a single series of daily fractions over a limited period of three to six weeks still controls radiological practice in the treatment of laryngeal cancer.

It is my privilege to present to you our experience in treating cancer of the larynx in the division of radiology at the University of California Hospital from 1931 to the present time. Until the end of 1942 this work was carried on by

Dr. Robert S. Stone, who as you know was called to head the health protection program of the Manhattan Project shortly after the outbreak of the war. The responsibility of carrying on radiation therapy has devolved upon me since 1943. During the whole period under consideration the work has gained immeasurably from the close cooperation between the divisions of otolaryngology and radiology; especially from the constructive and helpful attitude of the chairman of the division of otorhinolaryngology, Dr. Lewis Morrison, and the great interest of your president, Dr. Robert C. Martin. Dr. Morrison has been interested not only in the clinical aspects of the problem but also in the physical and biological problems of radiation. His understanding of radiological problems has contributed much to the development of our ideas in the radiological treatment of laryngeal cancer.

SELECTION OF CASES.

In the nearly 20-year period since 1931, a total of 224 patients with proven laryngeal cancer were seen in the division of radiology. Five of these were examined but for various reasons were not treated in our department. Sixteen patients received radiation therapy for surgical recurrences. Twenty patients, in almost preterminal stages of their disease, received not more than two or three treatments and, therefore, cannot be included as part of a group in which the therapeutic value of radiation procedure is to be analyzed. The follow-up is incomplete for 10 patients. Nine of these were treated between 1931 and 1940. Sixteen patients were treated with neutrons. Patients who received X-ray treatment postoperatively, or for surgical recurrences, or in whom surgery could not be carried out to the extent originally intended, we have excluded from our discussion because we are concerned here with evaluation of X-ray therapy as the primary method of treatment in cancer of the larynx. One hundred fifty-seven patients received a full course of X-ray treatment as a primary therapeutic procedure, complete follow-up has been obtained on all of them, and these patients are the subject of our analysis today. Of the 157 completed cases, 140 were males and 17 were females. Age distribution of the

patients is shown in Table 1. The youngest patient was 35 years old, the oldest 81 years old at time of treatment.

TABLE 1.

CARCINOMA OF THE LARYNX

INCIDENCE BY AGE AND SEX OF 157 X-RAY TREATED CASES

AGE	SEX		TOTAL
	MALE	FEMALE	
Under 40	3	–	3
41–50	25	7	32
51–60	50	3	53
61–70	48	5	53
71–80	12	2	14
Over 80	2	–	2
TOTAL	140	17	157

No restrictions were established for acceptance of patients for radiation therapy beyond the microscopical diagnosis of carcinoma. The patients were classified by the primary site of origin of the lesion regardless of subsequent extension, that is, the anatomical classification rather than the surgical classification or definition of intrinsic and extrinsic lesion was followed. We were fully aware of the confusion which results from such classification and from the fact that one is easily persuaded to interchange the anatomical and surgical meaning of the definition of intrinsic and extrinsic laryngeal lesion. In the analysis which I am presenting to you, tumors are not graded according to cellular differentiation. Of the 157 lesions, 153 were squamous cell carcinoma and four were adenocarcinoma. While little attention was paid to cellular differentiation, great attention was paid to the location and extent of the lesion, evidence of inflammation and infection, and the presence of metastases. Of the 18 lesions treated in the period between 1931 and 1935, 10 were intrinsic and eight extrinsic. Of the 24 lesions treated between 1936 and 1940, 16 were intrinsic and eight were extrinsic. Of the 59 lesions treated between 1941 and 1945, 47 were intrinsic and 12 extrinsic. Of the 56 lesions treated between 1946 and the present time, 44 were intrinsic and 12 were extrinsic.

TABLE 2.

CARCINOMA OF THE LARYNX

SURVIVAL BY CLASSIFICATION INTO INTRINSIC AND EXTRINSIC LESION

SURVIVAL YEARS	1931 – 1935		1936 – 1940		1941 – 1945		1946 – 1950	
	INTRINSIC	EXTRINSIC	INTRINSIC	EXTRINSIC	INTRINSIC	EXTRINSIC	INTRINSIC	EXTRINSIC
0-1	6	5	8	4*	11°°	9**	11°	6
1-2	1	2*	1	3	5°°	1	9°°	3
2-3	1	1	–	–	1	1	10°°°	1
3-4	1	–	1	1*	2*	–	4°°°°	2
4-5	–	–	1	–	h7o	–	10°°°°°	–
5	1	–	5	–	hh21°	1	–	–
TOTAL	10	8	16	8	47	12	44	12

* One died of intercurrent disease
** Two died of distant metastases
° Alive and well
°° One early
° Six early
°° Four early
°°° Seven early
°°°° Two early
°°°°° Seven early
h All early
hh Eight early

PERIODS OF OBSERVATION.

We have divided our observation into four time periods: the first, from 1931 to 1935, inclusive, the second from 1936 to 1940, the third from 1941 to 1945, and the fourth from 1946 to the present time. We have felt justified in dividing our observation period of 19 years for the following reasons: Dr. Robert Stone, chairman of the division of radiology, joined the University of California hospital staff in 1928. At that time no deep X-ray therapy was available in the department. The first 200 kv. therapeutic X-ray machine was installed in 1931. Two years later, through the cooperation of Dr. Stone, Dr. Ernest Lawrence and Dr. Sloan, a one million volt unit was built and put into operation in 1933. Accordingly, we think of the period from 1931 to 1935 as the pioneering period in Roentgen therapy in our department. A total of 18 patients, most of them with advanced laryngeal cancer, were treated in this period in an attempt to eliminate the malignant lesion locally by means of radiation.

The second period, that is, from 1936 to 1940, I should call the period of experimentation. The physical and biological effects of supervoltage radiation were studied. Comparison of effects of high voltage (200 kv. generated X-rays) and super voltage (one million generated X-rays) upon the skin and the underlying tissues held the center of interest. This period also includes experimentation concerning daily doses, total doses and time factor of fractionation. In this period a

total of 24 learyngeal cancers were treated. Although the majority were still advanced lesions, some early lesions, namely, those localized to the true vocal cord, as ascertained by indirect or direct laryngoscopy, were also referred for primary radiation therapy.

The third five-year period including the years 1941 to 1945 is characterized by a systematic approach to the problem. In this period a definite pattern of procedure was developed relative to the localization of the lesion, extent of the lesion and site or origin of the lesion; although strictest individualization was carried out in every case. In the period between 1941 and 1945, a total of 59 patients were treated.

Let me call the last period, since 1946, the period of modern expansion of the whole field of radiology. In this last period between January, 1946, and December, 1949, a total of 56 patients received primary radiation therapy for laryngeal cancer.

TABLE 3.

PATIENTS TREATED 1941-1945

SURVIVAL	1000 Kv.	200 Kv	COMBINATION		TOTAL
			A	B	
0-1	15	3	2		20
1-2	2		3	1	6
2-3			1	1	2
3-4	2				2
4-5	2		2	3	7
Over 5	6		13	3	22
					59

TABLE 4.

PATIENTS TREATED 1946-1949

SURVIVAL	1000 Kv.	200 Kv	COMBINATION		TOTAL
			A	B	
0-1	4	12	1		17
1-2		8	2	2	12
2-3		10	1		11
3-4	2		2	2	6
4-5	7		3		10
					56

FACTORS OF TREATMENT.

The 157 patients who comprise the entire group of cases who received complete treatment with X-ray as the primary therapy were treated either with high voltage or with super voltage radiation. It was always the intention to carry through the complete treatment with only one quality of radiation; however, in a number of instances, because of mechanical breakdown of one or the other equipment, it became necessary to treat the patients with both machines and thus with two different qualities of radiation — high voltage and super voltage radiation. The high voltage radiation consisted of X-rays generated by 200 kv. potential. Quality of the radiation in the 19 years has varied from 0.95 mm. copper to 1.3 mm. copper half-value layer. Focal skin distance was either 50 cb. or 80 cm. and the minute output varied from 45 r. to 50 r. for 50 cm. and from 15 r. to 19 r. for 80 cm. measured in air. Super voltage radiation consisted of X-rays generated by one million volt potential. The beam was filtered with 2.2 mm. of lead, 0.6 mm. tin, 1 mm. copper and 1.5 mm. aluminum. The quality of the radiation was that of 9 mm. copper half-value layer. The machine was operated at 2.5 or 3 milliampere intensities. The minute output varied between 19 and 22 r. measured in air at 70 cm. Treatment ports varied considerably from 5 x 5 to 10 x 15 cm. Fields were always square. Patients were treated in sitting position with the head fixed on a head rest and held in place by a head band. Positioning was always done by a senior radiologist. Field films were taken of the therapy setup to check position. On the super voltage machine positioning was checked with the aid of an exit beam localizer, on the high voltage machine, by visual positioning. Treatments were given daily except on Sundays. The daily dose fractions varied. Patients who were treated with high voltage X-rays received a maximum daily dose of 300 r. measured in air which corresponds to a tissue dose at 5 cm. depth for a 5 x 5 cm. field approximately 160 r. Patients treated with super voltage X-rays received daily doses up to 400 r. measured in air corresponding to a tissue dose at 5 cm. depth for a 5 x 5 cm. field to approximately 220 r. One hundred forty-one patients received treatment

through two opposing lateral neck fields, 12 patients were treated through a single anterior field, and in four patients who were treated in the first five-year period, three treatment ports were used, namely, two lateral ports and one posterior neck port. The treatment course varied between 18 to 25 days in the first and second periods but was extended up to 36 to 38 days in the third and fourth periods of our observations. Most of the patients since 1941 were treated in a period between 26 and 32 days.

The calculated tumor dose delivered in the first five-year period did not exceed 4,000 r. In the second five-year period the treatment dose varied between 4,000 r. and 6,000 r.; most of the patients received around 5,000 r. One patient in this period received 8,000 r. tumor dose and he is the patient with the longest survival of the whole group. In the period from 1941 to 1945 the tissue dose varied between 5,500 and 7,500 r. Patients were treated in a period between 28 and 35 days. Two patients received a tissue dose of 7,800 and 8,100 r., respectively, with super voltage radiation.

From 1946 to the present the tissue dose varied between 5,500 r. and 7,000 r.; the majority of patients received around 6,000 r. tissue dose with high voltage and around 6,500 r. with super voltage radiation. The treatment period extends over 32 to 38 days.

TABLE 5.

CARCINOMA OF THE LARYNX
SURVIVAL OF PATIENTS BY YEAR AND PERSISTENCE OF LESION

YEAR	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
NO. PATIENTS TREATED	3	4	2	6	3	6	4	4	4	6	2	8	12	17	20	19	12	16	9
LESS THAN 1YR WITHOUT CA					1					1			1		1		1		4
WITH CANCER	3	3	2	2	1	2	3	2	1	3	1	4	1	9	3	2	6	3	1
1-2 YEARS WITHOUT CA							1						1				1	6	4
WITH CANCER	1	1		1		1			1	1		1	2	1	1			1	
2-3 YEARS WITHOUT CA																1	4	6	
WITH CANCER				1	1							2							
3-4 YEARS WITHOUT CA				1		1										6			
WITH CANCER						1					1			1					
4-5 YEARS WITHOUT CA														1	6	10			
WITH CANCER										1									
OVER 5 YEARS WITHOUT CA				1		1		2	2			1	7	5	9				
WITH CANCER																			
TOTAL	18					24					59					36			

Analysis of the physical factors of X-ray irradiation reveals that in the period 1931 to 1935, five patients were treated with super voltage radiation, 10 were treated with high voltage radiation, and three were treated with a combination of super and high voltage radiation. One patient was treated predominantly with high voltage, two were treated predominantly with super voltage. Table 6 shows survival for this group.

TABLE 6.

PATIENTS TREATED 1931-1935

SURVIVAL	1000 Kv	200 Kv	COMBINATION		TOTAL
			A*	B**	
Under 1 Yr.	2	6	2	1	11
1-2		3			3
2-3	2				2
3-4	1				1
4-5					
Over 5		1			1
					18

* Predominantly supervoltage
** Predominantly high voltage

Twenty-four patients received X-ray treatment between 1936 and 1940. Sixteen received super voltage radiation, three received high voltage radiation, and five received a combination of both. In four cases radiation was predominantly super voltage, in the remaining case it was predominantly high voltage. Table 7 shows survival for the group.

TABLE 7.

PATIENTS TREATED 1936-1940

SURVIVAL	1000 Kv	200 Kv	COMBINATION		TOTAL
			A	B	
Under 1 Yr.	8	1	2	1	12
1-2	3		1		4
2-3					
3-4	1	1			2
4-5	1				1
Over 5	3	1	1		5
					24

Fifty-nine patients received X-ray treatment between 1941 and 1945. Twenty-seven received super voltage radiation, three received high voltage radiation and 29 received a combination of both. Twenty-one received predominantly super voltage and eight received predominantly high voltage. Table 8 shows survival of the group.

Fifty-six patients received X-ray treatment from 1946 to the present. Thirteen received super voltage radiation and 30 received high voltage radiation. Thirteen received a combination of both, with super voltage predominating in nine cases and high voltage predominating in four cases.

NEUTRON THERAPY.

The 16 patients treated with neutrons by Dr. Stone have been observed by me since 1943. All of them received neutrons generated in the 60-inch cyclotron by interaction of 16 Mev. deuterons with a beryllium target. Treatment was given by the fractionation method, and wherever possible by crossfire techniques. The rate of administration was around 5 n. per minute measured on the 100 r. chamber of the Victoreen condenser r. meter. The cyclotron operated erratically, making it necessary to vary the rate of administration, the daily doses, the number of fields treated per day, the total dose, and the number of days between the first and last treatment. Of the 16 patients, only two had lesions which could be called early lesions. One of these patients has survived for nine years and is well and active with a well preserved voice. In all the other patients the lesions were very extensive and definite metastases were present; many of the lesions were so extensive that it was impossible to distinguish between extension and regional metastases. Four of these patients received an incomplete course of neutron therapy. Of those who received a complete course, nine lived less than one year; two lived between one and two years and one, as I mentioned, is still living. This patient received 18 treatments in 48 days. The total dose was 509 n. I mention these neutron treated patients in order to show you the skin reactions immediately after treatment and eight years later in the patient who sur-

vived. It is obvious that the reaction was considerably more intensive immediately following treatment than that observed with high voltage or super voltage X-rays. The skin and subcutaneous tissue changes manifested as a late reaction two years after radiation with neutrons was considerably more intensive than we have seen with the highest dose ever given by us with super voltage or high voltage radiation. It may be mentioned that in the seven autopsy examinations in patients who had received neutron therapy, no tumor cells were found in the treated areas, but in all of these patients there were deep necrotic ulcers.

REACTION TO RADIATION.

The radiation reaction on the skin varied from moderate scaling to marked bullous epidermolysis and on the mucous membranes of the larynx from moderate mucositis to pseudomembranous mucosal reaction. The highest single field dose was 9,200 r. delivered in a period of 33 days. Color slides show early and late skin reactions following X-ray therapy in patients treated through a single port or through two "crossfire" ports in the period between 1941 and 1946. First marked reaction usually appeared around the twelfth to fourteenth day of treatment with high voltage radiation, while with super voltage radiation first marked reactions were delayed to the sixteenth to eighteenth day, when the whole treatment course was delivered in 28 to 32 days. Appearance of the reaction was generally in direct relation to the daily dose fractions. It was observed that the same skin effect was produced by approximately 20 to 25 per cent higher individual and total doses with super voltage radiation than with high voltage radiation. Mucosal changes were also less from super voltage radiation than from the same quantity of high voltage radiation. The reaction reached its height approximately five to seven days after conclusion of treatment and subsided usually in four to eight weeks after conclusion of treatment. The critical reaction period usually extended over a period of approximately 10 days. Five per cent boric acid ointment and/or 1 per cent benzocaine ointment was used to combat the acute reaction of the skin. Reaction of deep-seated tissue such

as cartilage may result immediately following or several years after radiation therapy. Perichondritis occurs in almost all advanced carcinoma of the larynx and may result early or late following radiation therapy. Approximately 2.5 per cent of our cases have developed perichondritis to some degree. In most instances it has coincided with persistence of tumor. Perichondritis is rarely caused by radiation alone, but is due to infection and inflammation of the tumor bed where the tumor infiltrates the vascular connective tissue, the lymphatics or invades the cartilage. In addition to starting the treatment with small initial doses of radiation, antibiotics should be employed in patients treated with radiation therapy during treatment and for approximately six weeks after radiation therapy. Occasionally almost complete regeneration of cartilage destroyed by tumor and inflammation may follow successful radiation therapy.

SURVIVAL ANALYSIS.

Of the 10 intrinsic lesions treated between 1931 and 1935, one patient has survived more than five years and is free of cancer. This patient was treated with high voltage radiation. One of the patients with extrinsic lesion treated in this period survived longer than two years.

Of the 16 patients with intrinsic lesions treated from 1936 to 1940, five, or 31.2 per cent, have survived more than five years free of cancer. Six patients, or 37.4 per cent, have survived more than four years free of cancer. Seven patients, or 43.7 per cent, have survived more than three years. Of the eight extrinsic lesions treated in this period, seven patients died within two years and one died in the fourth year after treatment.

Of the 47 intrinsic lesions treated from 1941 to 1945, 21 patients, or 45.8 per cent, have survived more than five years free of cancer. Twenty-eight patients, or 59.5 per cent, survived more than four years, 30 patients, or 64 per cent, have survived more than three years. Nineteen patients had early lesions localized to one cord. Of these, 15, or 79.2 per cent, have survived more than four years.

Of the 12 extrinsic lesions treated in this period one patient with primary cancer of the epiglottis had survived more than five years free of cancer.

TABLE 8.

SURVIVAL DATA AND CAUSE OF DEATH

Time of Survival	Patients Alive	Patients with Ca. or Regional Metastases	Patients Dead of Distant Metastases	Patients Dead of Intercurrent Disease	TOTAL
0-1 Yr.	5	50		5	60
1-2 Yrs	10	12		3	25
2-3 Yrs	11	4			15
3-4 Yrs	6	2	1	2	11
4-5 Yrs	16	1		1	18
Over 5 Yrs	26	0	1	1	28

Fifty-six patients were treated for laryngeal cancer from 1946 to the present time. Ten of these patients are alive more than four years after treatment and are free of cancer. Six patients are living more than three years after treatment and are free of cancer. Eleven patients are living more than two years after treatment and are free of cancer. Twelve patients are living more than one year after treatment. One of these patients has local cancer, the others are free of cancer. Twelve patients survived treatment less than one year. Of these 56 patients, 44 had intrinsic lesions.

DISCUSSION.

In the past 20 years since Coutard's presentation of his paper at the Otorhinolaryngological Convention in 1931, reports of more than 2,000 patients primarily treated with radiation are available. The statistical figures given by authors from different centers vary widely. When one tries to explain these wide variations of statistical data presented by expert investigators it becomes obvious that one reason for these is the lack of a common basis for evaluation of the cases, due to nonuniform classification of the lesions treated. As has been stated before, classification into intrinsic and extrinsic laryngeal tumors is entirely unsatisfactory, and gives rise to confusion and ambiguity. Comparison of neoplasms arising in various parts of the anatomical larynx reveals entirely different biological entities. Tumors of the true cord, for instance, grow slowly, metastasize rarely, while those arising on the

false cord or ventricles grow more rapidly and metastasize early. Tumors of the aryepiglottic fold, the pyriform fossa are not laryngeal tumors at all, either biologically or histogenetically.

Plans to introduce a classification based on the site of origin of a malignant lesion were attempted by Frenckner, in 1935, and by Lederman, in 1943. For the last year and a half, I have tried to formulate my own ideas concerning classification by site of the tumor which would satisfy the radiation therapist as well as the laryngologist and facilitate a better comparative analysis of treatment procedures among various centers here and abroad. I am taking this opportunity to present to you a plan of classification for your consideration in the hope that it may be adopted by your Society, and that such a step may lead to the establishment of an international classification of laryngeal cancers similar to that so generally adopted for cancers arising from the uterine cervix.

I have divided tumors of the larynx into two main groups: Group I includes tumors which arise from the true cord, and Group II includes tumors which arise on the ventricle, false cord, aryepiglottic fold, the epiglottis, subglottic area and pyriform fossa.

Tumors which arise on the true cord are divided into four stages:

Stage I: Involvement of not more than two-thirds of one vocal cord without impairment of mobility.

Stage II: Involvement of one cord and anterior commissure or part of both cords, without impairment of mobility.

Stages I and II are further subdivided into Group A: proliferative exophitic, and Group B: infiltrative-ulcerative.

Stage III: Tumors extend beyond the vocal cord involving the ventricle, false cord, arytenoid and/or subglottic region. Mobility is impaired partially or completely.

Stage IV: Tumor involves the true and false cords, arytenoids, and/or epiglottis. Mobility is impaired completely. Cervical metastases are usually present.

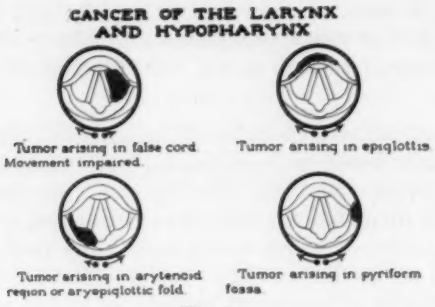
CANCER OF THE LARYNX
AND HYPOPHARYNX
Tumor arising in false cord. Movement impaired.
Tumor arising in epiglottis
Tumor arising in arytenoid region or aryepiglottic fold.
Tumor arising in pyriform fossa.

Fig. 1.

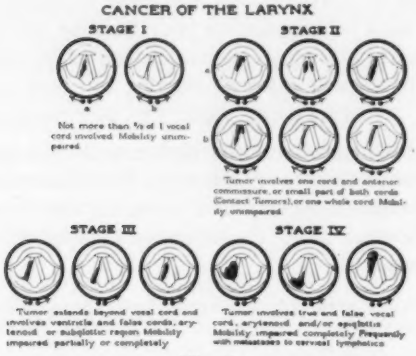
CANCER OF THE LARYNX
STAGE I
STAGE II
Not more than ½ of 1 vocal cord involved. Mobility unimpaired.
Tumor involves one cord and anterior commissure, or small part of both cords (Contact Tumors), or one whole cord. Mobility unimpaired.
STAGE III
STAGE IV
Tumor extends beyond vocal cord and involves ventricle and false cords, arytenoid or subglottic region. Mobility impaired partially or completely.
Tumor involves true and false vocal cords, arytenoid and/or epiglottis. Mobility impaired completely. Frequently with metastases to cervical lymphatics.

Fig. 2.

In our analysis we have paid little attention to the cellular differentiation or cell grading of the tumor, despite the fact that many authors consider cellular differentiation important in determining indication for radiation therapy, in deciding on management of treatment with respect to daily dose fractions and total dose, and in predicting response to radiation therapy. In my experience cellular differentiation is not an adequate basis for such decisions. It is often contended that lack of cellular differentiation is synonymous with radiosensitivity, that the tumor mass may disappear rapidly as all the irradiated cells respond almost at once. While this may be correct, it is a mistake to confuse radiosensitivity with radio-

curability. Radiocurability is measured by absence of recurrence in five-year period. Admittedly this definition is subject to discussion. In general, it may be stated that patients with laryngeal cancer who survive four to five years without recurrence very rarely succumb to the local disease at a later time. They may develop second malignancies, particularly of the mucosal linings at other sites, but very rarely do they develop metastases from the primary laryngeal carcinoma. The five-year "cure" rate in general is in good correlation with the average growth coefficient, that is, the rate of growth of laryngeal tumors. The growth coefficient is also closely related to the tendency to regional metastases. Lymph node involvement reduces radiocurability because tumors with a tendency to early lymph node involvement differ in their biology from those which tend to metastasize late. Undifferentiated anaplastic tumors have a high growth coefficient and tendency to spread. From the point of view of five-year survival they are most frequently incurable. It is, therefore, obvious that the two terms, radiosensitivity and radiocurability are not interchangeable. On the contrary, they represent diametrically opposite biological behavior of the tumor relative to a therapeutic agent. It is also true that the degree of cellular differentiation may not be uniform throughout the tumor or in the primary tumor and in the involved lymph nodes. A biopsy taken from one area of the tumor or from a lymph node, therefore, may fail to represent accurately the chief cellular differentiation of the tumor as a whole. For these reasons I am unable to agree with some of my colleagues who pay so much attention to cellular appearance of the biopsy specimen in conducting treatment, deciding on treatment method and predicting the outcome of therapy. On the other hand, I believe that clinical classification of the tumor into proliferative-exophitic and infiltrative-ulcerative is a valid guide in carrying out radiation therapy. Exophitic tumors, even when large, are prognostically more favorable than infiltrative-ulcerative tumors even when the latter are of small size. Ulcerative-infiltrative tumors interact with the tumor bed much more than exophitic-proliferative tumors and so affect primarily the vascular connective tissue of the tumor

bed which plays such an important part in the ultimate healing of the patient.

Much has been learned from the experience of the past 20 years, our techniques have undergone modification, and certain practices accepted in earlier days are now eliminated. Some of these relate to physical factors of treatment, others to clinical management. Radiation therapists differ as to whether super voltage or high voltage radiation is preferable in the treatment of cancer of the larynx; however, skepticism is restricted to those whose experience with super voltage radiation is limited. The physical superiority of super voltage radiation is beyond debate. It provides greater penetration, sharper delineation of the treatment beam, which makes possible irradiation of a much smaller volume of tissue than is possible with high voltage radiation. By decreasing the volume irradiated it is possible at the same time to accomplish one fundamental objective of radiation therapy, namely, to deliver a high tumor dose to a small tumor-bearing area with proper protection of the vascular connective tissue tumor bed. This protection is a factor of paramount importance in insuring regeneration following the intensive focal radiation reaction which is necessary for the eradication of the neoplasm. Healing of the tumor bed is as important to recovery as is the destruction of the tumor itself. The volume dose for equal skin dose is greater with super voltage than with high voltage radiation, but for an equal tumor dose the volume dose is lesser with super voltage than with high voltage radiation. While a small volume bears upon the deep tissue effect, it is also important with regard to skin effect, which is approximately 25 per cent less when super voltage radiation is used than when high voltage X-rays for the same quantity of incident radiation. The lesser skin effect with super voltage radiation can be attributed to two factors: *1.* lesser absorption of predominantly shorter wave length components of the super voltage radiation by the sulphur containing elements of the skin; *2.* the electron equilibrium from super voltage radiation, due to lesser back scatter, is reached below the uppermost layers of the skin. Finally, one must realize that the energy

absorption in ergs per Roentgen in calcified and bone tissue is considerably less with super voltage radiation than it is with high voltage radiation. This is an important factor in the irradiation of the larynx because of the frequency of calcification of the cartilage.

Over and above the physical advantage of super voltage radiation, there are also clinical advantages which, although they are not reflected in survival statistics, do unquestionably contribute to the patient's well-being during and after treatment. The recovery period is shorter following super voltage r. radiation. Despite these convictions, no attempt is made in our analysis to evaluate statistically the differential effect of super voltage and high voltage radiation. Such a statistical evaluation would be possible only if we had treated alternate patients exclusively with super voltage radiation and the others exclusively with high voltage radiation.

No strict rules can be formulated concerning the total dose to be employed in the attempt to eradicate various types of laryngeal cancers. In general, it may be said that less than 5,500 r. calculated tumor dose is inadequate to destroy the lesion. On the other hand, a dose in excess of 7,500 r. calculated on the tumor-bearing area may produce such untoward effects on the tumor bed that healing is inhibited and deep ulceration, infection and necrosis and their sequelae may ensue. In most of our cases we did not exceed a tumor dose of 6,500 r. If such a dose does not result in destruction of the tumor, surgical intervention can be carried out without interference, assuming that only a small volume of tissue was irradiated.

The method of fractionation varies from place to place. Some authors advocate that 4,900 r. is the proper dose to be given in 20 days, 5,800 r. in 30 days. Others advocate 6,700 r. when it is given in 40 days, 7600 r. in 50 days, 8,500 r. in 60 days; however, it is erroneous to assume that the given dose in Roentgens always produces the same biological effect. The size, the shape, the number and the location of the skin portals, the direction of the incident beam, the quality of radia-

tion must be taken into consideration in every individual instance. Personally I believe that delivering an assumed carcinocidal dose of 5,500 r. to 7,000 r. in a period of less than 28 days produces a too severe tissue reaction; similarly, extension of treatment beyond 35 to 38 days is not desirable because of probability of cell recovery on the one hand and connective tissue damage on the other. Some inflammation is observed in most laryngeal cancers. For this reason, it is our practice to institute radiation therapy with doses which do not exceed 50 to 75 r. calculated on the larynx during the first two to four days. In this way it usually is possible to avoid initial edema of the larynx which may necessitate tracheotomy. Although tracheotomy does not contraindicate radiation therapy, it does interfere with the radiological management of the patient.

Coutard in his original work advocated low intensity, which is synonymous with protraction of treatment. Neither experimental work nor clinical experience has confirmed the validity of this theory. In our practice we treat one field a day in periods lasting from 10 to 25 minutes. In my own view there may be merit in treating the patient twice daily with smaller individual doses. It is recognized, however, that such a procedure would offer practical difficulties for most patients and to most institutions.

Of equal importance with the physical factors is the exact positioning of the patient. Neglect or errors in positioning may result in overdosage to some areas and underdosage to others, either of which may prove to be the crucial factor in success or failure of the treatment. The importance of this consideration is due in part to many treatment days involved in a full course of therapy. It is necessary to keep the patient under constant surveillance during treatment to be sure that his position does not change during exposure.

It is usual in most centers to treat laryngeal cancers through two opposing crossfiring fields. From the point of view of delivery of a uniform dose this technique leaves something to be desired. Unavoidably, areas of overirradia-

tion, so-called "hot spots," occur, as has been shown by Mayneord and other British investigators. To some extent this can be avoided by homogenizing the tissue volume under irradiation, which can be accomplished with special treatment cones, rice bags or other devices. We have treated 12 patients experimentally through a single anterior field, and the patient who received the highest dose by this method, namely, 8,200 r. calculated on the larynx, is alive and well, more than five years after treatment with very little skin changes and practically no subcutaneous sclerosis. Another patient who received 5,500 r. tissue dose also by this method developed a perichondritis with all the usual complications. It is our conclusion that when single field treatment is employed the field size should not exceed 3 cm. in diameter when a round field is used or 3 x 3 cm. for a square field. Accordingly, we believe that single-field treatment should be limited to very small, localized tumors. At present we are interested in multiple field and rotational therapy. By placing the patient in such a position that the larynx is in the rotational axis, a very narrow treatment beam can be employed, which facilitates delivery of a dose to the tumor with such great accuracy that a differential of more than five to one between the tumor and the tissue may be attained.

In giving the necessary close attention to the physical aspects of the treatment, one must not, of course, overlook the needs of the whole organism of which the tumor is only a small part. Radiation therapy is an exhausting procedure for the patient. Consequently, preliminary examination to determine the patient's general condition is of great importance. This must include examination of the cardiovascular system, lungs and kidneys. A Wassermann reaction should be taken since tissue healing is markedly impaired in active luetic patients. In case of active lues, antiluetic treatment should be carried on simultaneously with radiation therapy. During treatment, daily examination is of great importance. The patient's nutrition must be carefully supervised. It is preferable to hospitalize the patient in the fourth week of treatment and to keep him in the hospital for one or two weeks after the con-

clusion of treatment. Weekly follow-up examinations for the first six weeks after conclusion of treatment, and then biweekly examination for the next three months should be the rule. If untoward effects develop in this period and are recognized early, surgical intervention may be carried out easily. In my opinion, it is ill advised to repeat a course of radiation therapy after failure.

It is my strong belief, based upon the experience which I have described, that when all precautions and safeguards, both physical and clinical, are observed, radiation therapy is a satisfactory means of treating laryngeal cancer. In early cases limited to the vocal cord, I believe that radiation is the treatment of choice. Radiation properly administered leaves the larynx with the least anatomical or functional impairment. Restricting radiation therapy to advanced cases or to treatment of postoperative recurrences or the palliation of hopeless cases is not warranted in the light of modern results. Admittedly, there is room for further improvement of radiological techniques and in view of development in the field of radiation, we may anticipate further great improvement in the use of X-rays in the not far distant future.

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BOOK REVIEW.

Hearing Tests and Hearing Instruments. Leland A. Watson and Thomas Tolan, M.D., Baltimore, Md.: The Williams & Wilkins Co., 1949, 597 pp. $7.00.

This book contains the following six major parts: Backgrounds of the Audiometer, Interpretations of Audiometric Data, Technical and Engineering Aspects of the Audiometer, Social Aspects of Audiometry, Hearing Aids and Advanced Audiometry. It includes an elaborate bibliography and a glossary of terms in audiology. The stated object of the book is to provide a comprehensive and primarily practical text on hearing instruments and their application. It is intended to serve physicians, school nurses, rehabilitation officers and those who dispense and fit hearing aids.

The authors present a rich body of information from a wide variety of sources hitherto unavailable in compact form. Certainly the extensive bibliography, although unorthodoxly arranged, constitutes an extremely helpful guide for those probing deeply into the problems of hearing and deafness.

This reviewer questions whether the book can be regarded as a definitive "text" in the field. The levels of difficulty of the material undulate disconcertingly from relatively elementary concepts to concepts which would elude even sophisticated clinicians. The authors imply that this happens, but they should be aware that a "text" also implies a reasonable degree of uniformity.

The equivalence assigned to widely differing (in amount, kind and accuracy) information to support certain points of view is also disturbing when it appears in a "text." Carefully gathered laboratory data are implicitly refuted by subjective opinions, the validation for which is not apparent.

The repeated appearance on audiogram charts and batteries of the name of the firm with which one of the authoris connected serves no useful purpose and certainly detracts from the objectivity or disinterestedness for which a "text" in a scientific field should strive.

The book contains much that is helpful but the reader should evaluate the material critically. This would be a useful exercise for anyone interested in hearing, including the "experts." S. R.S.

IMPORTANT NEW PRODUCT ANNOUNCED FOR THE TREATMENT OF SINUSITIS.

Another new member of the furacin(R) family of topical antibacterial preparations is announced by Eaton Laboratories, Inc.: Furacin Nasal with Ephedrine. This special aqueous solution of furacin with ephedrine is indicated for the treatment of sinusitis and rhinitis of bacterial origin.

Furacin Nasal was evaluated on over 300 patients at a leading medical center. Many cases of chronic sinusitis and rhinitis were cured; cases of chronic atrophic rhinitis were markedly benefited. Many gram-negative and gram-positive bacteria proved susceptible to this preparation. Sensitization occurred in only one of these 300 patients.

Other clinical preparations of furacin, brand of nitrofurazone N. N. R., now include Furacin Soluble Dressing, Furacin Solution, Furacin Anhydrous Ear Solution and Furacin Vaginal Suppositories.

Furacin Nasal with Ephedrine is supplied in dropper bottles of 30 cc. in cartons with slip labels.

MISSISSIPPI VALLEY MEDICAL SOCIETY MEETING AT SPRINGFIELD, ILL., SEPT. 27, 28, 29, 1950.

The fifteenth annual meeting, Mississippi Valley Medical Society, will be held at the Elks Club, Springfield, Ill., Sept. 27, 28, 29 under the presidency of Dr. N. G. Alcock, of Iowa City, Iowa, immediate past-president of the Iowa State Medical Society. Over 30 clinical teachers from the leading medical schools will conduct this great postgraduate assembly whose entire program is planned to appeal to general practitioners. There will be over 50 scientific and technical exhibits, noon round table lunchons, etc. *No registration fee* will be charged and every ethical physician is cordially invited and urged to attend. The entire program and all exhibits will be held in the newly remodeled, air-conditioned Elks Club of Springfield. The American Medical Writers' Association will hold its annual meeting at the Elks Club on Sept. 27. Programs of both meetings may be obtained from Dr. Harold Swanberg, secretary, M. V. M. Society and A. M. W. Association, 209-224 W. C. U. Building, Quincy, Ill.

HEARING AIDS ACCEPTED BY THE COUNCIL ON PHYSICAL MEDICINE OF THE AMERICAN MEDICAL ASSOCIATION.

As of April 1, 1950.

Aurex Model F and Model H.
Manufacturer: Aurex Corp., 1117 N. Franklin St., Chicago, Ill.

Beltone Mono-Pac; Beltone Harmony Mono-Pac; Beltone Symphonette.
Manufacturer: Beltone Hearing Aid Co., 1450 W. 19th St., Chicago, Ill.

Cleartone Model 500; Cleartone Regency Model.
Manufacturer: American Sound Products, Inc., 2454 S. Michigan Ave., Chicago 16, Ill.

Dysonic Model 1.
Manufacturer: Dynamic Hearing Aids, 43 Exchange Pl., New York 5, N. Y.

Electroear Model C.
Manufacturer: American Earphone Co., Inc., 10 East 43rd St., New York 17, N. Y.

Gem Hearing Aid Model V-35.
Manufacturer: Gem Ear Phone Co., Inc., 50 W. 29th St., New York 1, N. Y.

Maico Type K; Maico Atomeer; Maico UE-Atomeer.
Manufacturer: Maico Co., Inc., North Third St., Minneapolis, Minn.

Mears Aurophone Model 200; 1947—Mears Aurophone Model 98.
Manufacturer: Mears Radio Hearing Device Corp., 1 W. 34th St., New York, N. Y.

Micronic Model 101 (Magnetic Receiver); Micronic Model 303. (See Silver Micronic.)
Manufacturer: Micronic Co., 727 Atlantic Ave., Boston 11, Mass.

Microtone T-3 Audiomatic; Microtone T-4 Audiomatic; Microtone T-5 Audiomatic; Microtone Classic Model T9.
Manufacturer: Microtone Co., 4602 Nicollet Ave., Minneapolis 9, Minn.

National Cub Model C; National Standard Model T; National Star Model S.
Manufacturer: National Hearing Aid Laboratories, 815 S. Hill St., Los Angeles 14, Calif.

Otarion Model E-1; Otarion Model E-1S; Otarion Model E-2; tarion Model E-4; Otarion Models F-1 and F-2.
Manufacturer: Otarion Hearing Aids, 159 N. Dearborn St., Chicago, Ill.

Paravox Models VH and VL; Paravox Model XT; Paravox Model XTS; Paravox Model Y (YM, YC and YC-7).
Manufacturer: Paraphone Hearing Aid, Inc., 2056 E. 4th St., Cleveland, Ohio.

Radioear Permo-Magnetic Multipower; Radioear Permo-Magnetic Uniphone; Radio Ear All Magnetic Model 55.
Manufacturer: E. A. Myers & Sons, 306 Beverly Rd., Mt. Lebanon, Pittsburgh, Pa.

Silver Micronic (Crystal Receiver) Model 101; Silver Micronic (Magnetic and Crystal) Models 202M and 202C. (See Micronic.)
Manufacturer: Micronic Corp., 101 Tremont St., Boston 8, Mass.

Silvertone Model 103BM.
Distributor: Sears-Roebuck & Co., Chicago, Ill.

Sonotone Model 600; Sonotone Model 700; Sonotone Model 900; Sonotone Models 910 and 920; Sonotone Model 925.
Manufacturer: Sonotone Corp., Elmsford, N. Y.

Superfonic Hearing Aid.
Manufacturer: American Sound Products, Inc., 2454 S. Michigan Ave., Chicago, Ill.

Televox Model E.
Manufacturer: Televox Mfg. Co., 117 S. Broad St., Philadelphia 7, Pa.

Telex Model 22; Telex Model 97; Telex Model 99; Telex Model 200; Telex Model 1700.
Manufacturer: Telex, Inc., Minneapolis 1, Minn.

Tonemaster Model Royal.
Manufacturer: Tonemasters, Inc., 1627 Pacific Ave., Dallas 1, Tex.

Trimm Vacuum Tube No. 300.
Manufacturer: Trimm, Inc., 400 W. Lake St., Libertyville, Ill.

Unex Model "A"; Unex Midget Model 95; Unex Midget Model 110.
Manufacturer: Nichols & Clark, Hathorne, Mass.

Vacolite Model J.
Manufacturer: Vacolite Co., 3003 N. Henderson St., Dallas 6, Tex.

Western Electric Model 63; Western Electric Model 64; Western Electric Models 65 and 66.
Manufacturer: Western Electric Co., Inc., 120 Broadway, New York 5, N. Y.

Zenith Model 75; Zenith Miniature 75.
Manufacturer: Zenith Radio Corp., 6001 Dickens Ave., Chicago, Ill.

All of the accepted hearing devices employ vacuum tubes.

Accepted Hearing Aids more than five years old have been omitted from this list for brevity.

TABLE HEARING AIDS.

Aurex (Semi-Portable)—*Jour. A. M. A.*, 109:585 (Aug. 21), 1937.
Manufacturer: Aurex Corp., 1117 N. Franklin St., Chicago (10), Ill.

Precision Table Hearing Aid—*Jour. A. M. A.*, 139:785-786 (Mar. 19), 1949.
Manufacturer: Precision Electronics Co., 850 West Oakdale Ave., Chicago 14, Ill.

Sonotone Professional Table Set Model 50—*Jour. A. M. A.*, 141:658 (Nov. 15), 1949.
Manufacturer: Sonotone Corp., Elmsford, N. Y.

All of the Accepted hearing devices employ vacuum tubes.

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"There's no such animal," he cried!

MY FRIEND and I were picking the ponies one day when I started telling him about *a sure thing* I heard about.

"You say it pays four bucks for every three?" he asked. "And can't lose? It *automatically* wins? Must be illegal!"

"Not a bit," I replied. "In fact, the government very much approves..."

"Our government approves of a horse who can't lose..."

"Who said anything about a horse?" I asked.

"So what else could it be but a horse...?"

"It not only could be—but is—U. S. Savings Bonds," was my prompt reply.

"For every three dollars you invest in U. S. Savings Bonds you get four dollars back after only ten years. And if you're a member of the Payroll Savings Plan—which means you buy bonds *automatically* from your paycheck — that can amount to an awful lot of money while you're not looking. Hey, what are you doing?"

"Tearing up my racing form! The horse I'm betting on from now on is U. S. Savings Bonds."

Automatic saving is <u>sure</u> saving—U.S. Savings Bonds

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